AMERICAN MACHINIST

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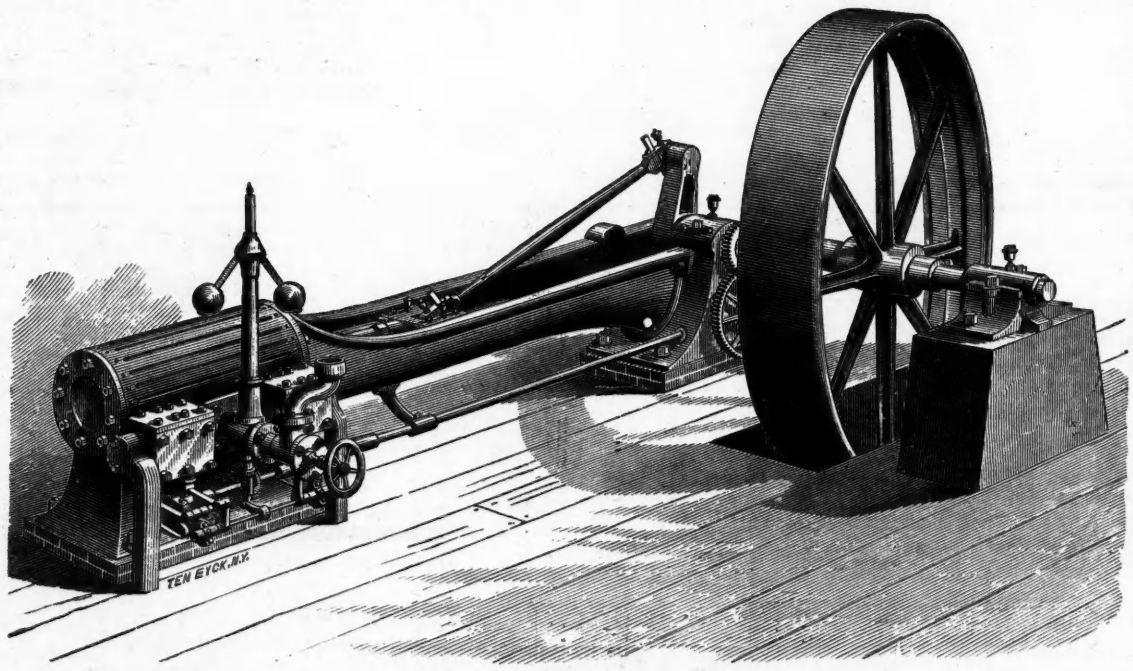
Improvements in Steam Engines.

BY STEPHEN ROPER, ENGINEER.

The Putnam Machine Company's High Pressure Variable Cut-Off Engine.

The annexed cut represents the *Putnam Machine Company's high-pressure variable cut-off engine*, the frame or bed-plate of which is designed with reference to strength and rigidity, and also to answer either for right or left hand pillow block bearings. The almost universal reciprocating valve motion derived from an eccentric is dispensed with, and a rotary motion derived from a gear on the crank-shaft substituted. By means of miter gears the motion is communicated to a shaft running parallel with the axis of the cylinder beneath the valves, and carrying cams for lifting the latter. The steam chests, one at either end of the cylinder, contain each a steam and an exhaust valve of the balance or double popped form, having flat faces and seats, and are capable of being removed entire from the steam chests by simply removing a bonnet or cover on the top of the latter. The valve-stems pass through the necessary stuffing boxes in the bottom of the steam chests. The shape and adjustment of the cams for working the valves give them the proper lift, lap, lead, etc. The opening and closing of the valves is very quick, the duration of opening being an interval of rest between the upward and downward motions.

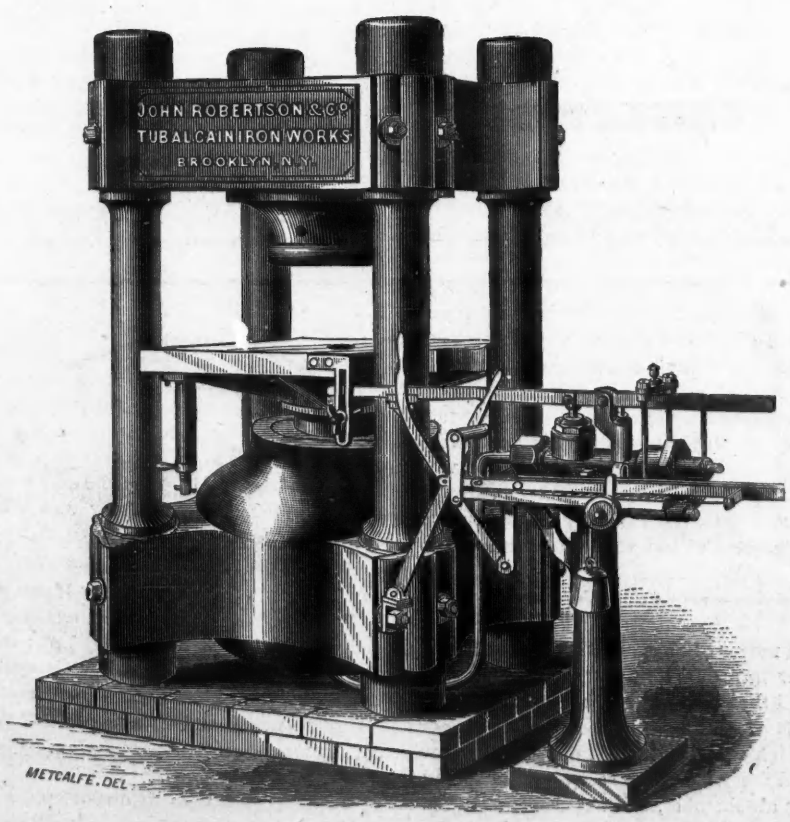
The governor, which is of the ordinary centrifugal form, is driven by bevel gears from the cam-shaft, thus receiving a positive motion. Below the cam-shaft is a rack-shaft having three arms, the center one of which is attached to the lifting rod or spindle of the governor, from which the rack-shaft receives a slight oscillating motion, while those at the ends, which are at right angles with the center arm, connect with the lifting toes of the steam valve. The shape of the lower faces of the lifting toes which rest upon the cams is such, that when moved inward towards the cylinder by the motion of the governor transmitted through the rack-shaft, a curved upward offset is reached by the cam as it revolves, and the valve is lowered so quickly as to have the effect of being actually released and allowed to drop to its seat, while at the same time it is supported by the lifter. The interval between the full lift of the valve and the reaching of the offset by the highest point of the cam determines the point of cut-off, and insures sufficient lift of the valves. The advantage claimed for this arrangement is, that by keeping the valve always supported while open, the danger of slamming is avoided without the necessity of a dashpot, which, in cases where the valve is tripped or released, is absolutely indispensable.



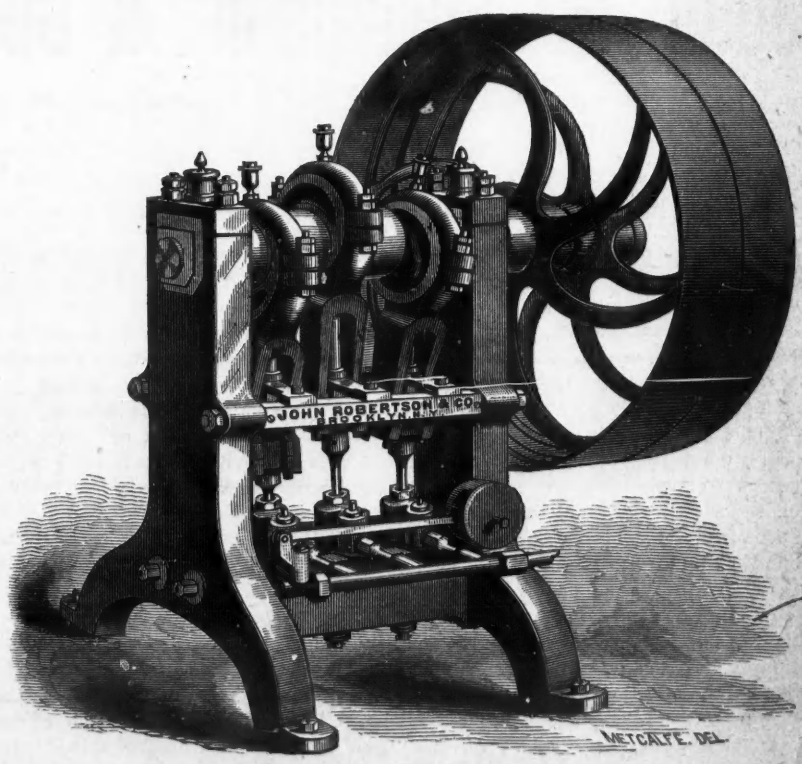
THE PUTNAM STEAM ENGINE.

When these engines are started, and until the speed for which the governor is adjusted is reached, the steam necessarily follows full stroke, as the cut-off is inoperative. But as soon as the regular speed is attained, the motion of the governor thrusts the center arm of the rack-shaft downward, thereby causing the arms to which the lifting toes are connected to move towards the cylinder. This brings the offsets of the lifting toes nearer to the cams, causing them to drop sooner, thus cutting off the steam at the proper point. In case of the removal of the entire load from the engine induced by the breaking of a belt, etc., the governor, owing to its positive motion, will effectually check any attempt at "running away," as the offsets on the lifting toes will be thrust so far inward that the cams will not raise the valves from their seats until the speed is again reduced to the proper point.

It is claimed that under the above-mentioned circumstances the engine will not make one full revolution before being completely under the control of the governor. All the sliding and bearing surfaces of the valve gear of these engines are made of hardened steel, thus preventing the liability of rapid wear, and also requiring very little power to move the valves. The fly-wheels are turned on the face and edges. The shafts, crankpins and connecting rods are made of the best material, and the bearings are ample and well proportioned. The workmanship is excellent and the finish neat and attractive. In fact, these engines



ROBERTSON'S HYDRAULIC STAMPING PRESS.



ROBERTSON'S HYDRAULIC PUMP.

rank among the most simple, durable and economical in the country. They are manufactured by the Putnam Machine Company, Fitchburg, Mass.

New Hydraulic Stamping Press Valves and Pump.

Hydraulic presses and pumps are now extensively in use for an endless variety of manufacturing purposes, of which most of our readers have but little conception. We propose in this brief article to let them know some of the many uses to which these presses and pumps are applied. In Europe, especially England, hydraulic machinery is more extensively in use than in this country, but in this class of machinery, as in many others, we are making rapid strides to take the lead of the world.

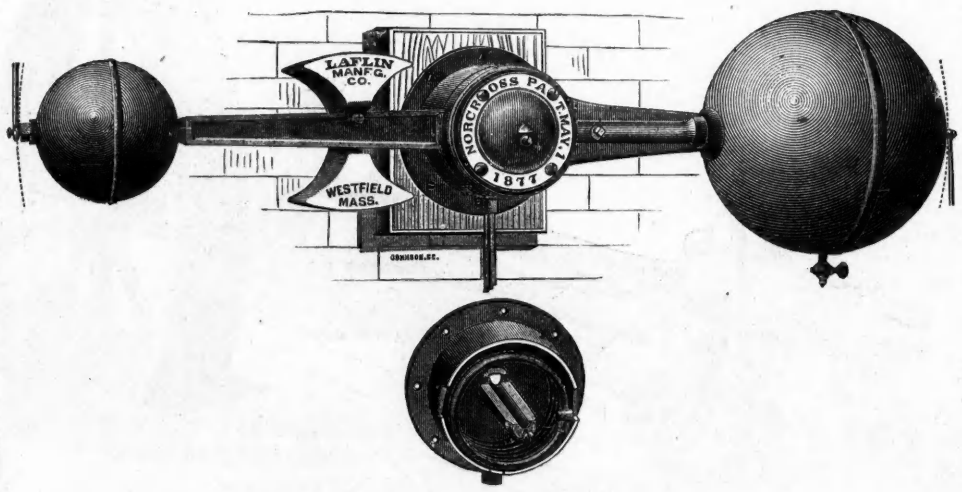
Many branches of industry where screw, cam and toggle presses are in daily use for medium and heavy pressure, will in course of time adopt the hydraulic press in preference to that which they are now using. It is generally supposed that the hydraulic press is too slow for ordinary purposes, and this is quite true so far as the ordinary hydraulic press is concerned; but with the aid of accumulators, hydraulic presses can be worked as quickly as any known method of working presses. In speaking of hydraulic accumulators some of our readers may not be familiar with the method of working them, and for the benefit of those who are not, we give a short outline of the advantages to be gained by its use. The accumulator is used for the purpose of storing power for working all kinds of hydraulic machinery; it can be made of any size and sufficient strength suitable for the purpose to which it is to be applied, and it will exert a power equal to the greatest obtained by hydraulic or any other power, while the steady force is always maintained and transmitted at a much more rapid and uniform rate of speed unequaled by the use of hydraulic pumps direct. This is a mode of working hydraulic presses that comparatively few know the importance of, and at some future time we may take up the subject and show our many readers the several uses to which it might be applied with great benefit. There are various kinds of accumulators made, but the simplest and safest is that which consists of a strong cylinder made of any suitable metal, such as steel, wrought or cast iron, with a steel or iron ram and a cast iron head, to which is suspended a platen or box by means of wrought iron rods to carry the weight.

A very important branch of industry has recently had an impetus to its trade from the use of hydraulic power, and when we look upon some of the work produced it seems perfectly marvelous. We refer to the silver and britannia ware manufacturers, who, until recently, have had the beautiful designs engraved on their wares by hand, at great expense, requiring skilled workmen to perform it. Small articles have been shaped or embossed by heavy screw and cam presses, but anything over four or five inches is beyond their capacity. The new, or comparatively new, process now in use by the most extensive eastern manufactories of that kind, by means of dies engraved with the most elaborate designs thereon, and with the aid of a powerful hydraulic press, pumps and attachments thereto, as shown in the above illustrations, a uniform and sharp impression is imparted to the articles with great rapidity, giving them a handsome finished appearance, which could never be obtained by hand engraving. Some idea may be formed of the great advantage of this process over the old method of engraving each single article by hand, when we say that some articles would take many hours for a skilled workman to finish, whereas by this new and simple process after the dies are engraved and put in the press they can be engraved, as it were, at the rate of two hundred to two hundred and fifty impressions per hour, thereby lessening the cost of manufacture.

The illustrations show a powerful hydraulic press with automatic valves to regulate the impression; also a set of triple eccentric pumps to work the same, for which the manufacturers claim many advantages over anything of the kind ever introduced for forming, stamping and raising all kinds of ware. The process can be applied to many branches of manufacture. For instance, the manufacturers are now building a whole plant of the above for use in manufacturing undertakers' materials, and the benefit arising from the use of these presses, require only to be known to be generally adopted.

The presses, pumps and valves are carefully and accurately fitted in all their parts. The platen of the above press is 28x31, and will take in blanks of that size, but presses of any size can be made to order. It is not necessary to use a large quantity of water in operating these presses, as the same water is returned to the cistern again. They are made by John Robertson & Co., Brooklyn.

WORKING STEEL FOR TOOLS.—In working steel for tools, great care should be taken to hammer all sides alike, for if one side is hammered more than another, it will cause it to spring in hardening. Again, steel, when being hammered, should be heated as hot as it will stand, until finishing, and should then be hammered until almost black hot, for the reason that it sets the grain finer, and gives the tool a better edge. The reason for heating the steel so hot while hammering is simply because it makes the steel tougher, when hardened, and softer when annealed, while if it were worked at a low red heat, the continued percussive shocks of the hammer would so harden it as to make it almost impossible to anneal it, and at the same time render it brittle when hardened.



THE NORCROSS STEAM DAMPER REGULATOR.

The Norcross Steam Damper Regulator.

The illustrations on this page represent the Norcross Steam Damper Regulator, designed for regulating the pressure on steam boilers, water and gas mains. This is claimed to be the only successful pressure governor that works without a rubber diaphragm and plunger, it being made entirely of metal with no packed joints.

The cut represents a cylindrical casing of any suitable dimensions, which is to be made fast to a wall or other suitable support. In the center of this casing projects a horizontal arm, having a longitudinal groove or bearing in its upper side as shown in sectional view of cut.

On the front end of the casing is placed a rim provided with an annular flange corresponding with and loosely resting against the edge of said case, to allow for the lateral motion caused by the oscillation of the working-beam, and to which is fastened the cap. And this cap has a stem or arm projecting inward from its center forming the support or bearing of the beam and its attachments. On the under side of the stem or arm are formed knife-edges, which rest in the groove or bearings on the arm, and on which the rim can thus tilt from side to side. In the back of the casing and in the cap are formed segmental projections which overlap the ends of the arms or stems by which they are held in position. From one side of the rim projects a beam which may be graduated or not as desired, and on the end of this beam is formed or attached a weight preferably in ball form. The weight is a movable poise on the beam, to be placed at any point desired according to the pressure to be maintained and fastened at such point by a set-screw or otherwise.

From the opposite side of the rim and in the opposite direction from the beam extends a hollow arm having an air-chamber attached on its outer end, and which nearly or quite balances the weights on the beam end. In the inner end of the arm is screwed or otherwise connected one end of a brass pipe which is coiled within the casing, performing in a small degree the function of a volute spring, and the other end of said pipe is attached by a connection to the casing.

This connection is to be connected by a suitable pipe with the water space of the boiler.

In the outer end of the hollow arm is screwed or otherwise connected a curved pipe which lies within the air-chamber and extends nearly to the bottom thereof.

The air-chamber is full of air and should be made perfectly air and water-tight.

The governor or regulator thus constructed being connected by means of the coil and hollow arm with the water space of the boiler, as described, the operation is as follows: When the pressure of the boiler increases the water is forced by the steam into the coil through the same and through the hollow arm and pipe into the air-chamber, compressing the air therein in the top of the chamber. As the pressure of the steam in the boiler decreases the water is forced back into the boiler from the air-chamber by the expansive force of the air previously compressed.

This is the principle upon which the regulator or governor operates.

The weight on the beam being set at a certain pressure the air-chamber will remain up until the pressure in the boiler exceeds such amount; but at that time sufficient quantity of water has been forced from the boiler into said chamber to overbalance the weights on the opposite end of the beam, and hence the whole rim tilts on its knife-edges, the air-chambers dropping down the desired distance.

The air-chamber and weight being, by rods connected with the dampers, of course such movement operates said dampers to decrease the heat in the furnace and hence all the pressure in the boiler.

Then as the pressure decreases the air-chamber becomes lighter by the expansive force of the compressed air forcing back the water, and then the apparatus tilts again to its former position, reversing the dampers again, shutting or opening them, as the case may be. This device may be applied in any way to regulate the steam-pressure whether in the boiler itself, or in any apparatus connected with the boiler by connecting one or both arms of the apparatus with the necessary valves or cocks.

If from any cause the air should be exhausted from the chamber it is re-supplied by means of an air valve attached to the hollow arm. The water in the air-chamber will then pass out and air rush in to fill it.

It may also be applied for gas pressure in which case a water-chamber will be provided and the water from said chamber forced into the air-chamber, this water-chamber then taking the place of the boiler.

The pipe being coiled in the casing forms a flexible oscillating conduit joint allowing the apparatus to work or vibrate easily without friction.

The advantages derived by having a reliable damper regulator attached are too well understood by people using steam boilers to be reiterated. In presenting this to the public, the manufacturers claim they have secured a perfect steam damper regulator, and one that *cannot be excelled*—it being frictionless, having no working joints—and the simplest, therefore the best.

The regulator is so made as to weigh the pressure, and is so sensitive that the slightest variation in pressure works upon it. The damper can be attached to either end of the regulator, or the damper in flue attached at one end, and the draft door to the other.

The pressure of steam on the boiler is regulated by moving the poise out or in on the beam.

It is reliable and accurate—working on an entirely new principle, and is claimed, it can never get out of order.

Some of its prominent advantages may be tersely stated as follows:

Great saving in fuel.

Needs no oil or attention.

It is worked entirely by weight, and not by pressure.

No diaphragms to wear out or burst.

No interruption in working from rust.

A great preventive of boiler explosions.

For circulars and further information, address the manufacturers, Laflin Manufacturing Co., Westfield, Mass.

The Institution of Mechanical Engineers was in annual meeting in London on Thursday and Friday, and the members had a number of interesting and important papers before them. That most cognate to our specialty was "On Experiments relative to steel boilers," by Mr. William Boyd, of Newcastle-on-Tyne. We cannot give the whole of Mr. Boyd's experiments at length, but may say that he summarises his conclusions as under:

1st. Steel plates can now be obtained in which absolute practical uniformity can be relied on, extended over a large quantity of material.

2nd. The material is seriously injured, or crippled, to the extent of something like 33 per cent. by punching—if the clearance given between the punch and the die be about one sixteenth of an inch, which is usual in good boiler-making work.

3rd. The injury, or crippling of the material does not amount to any appreciable quantity, if the holes are drilled.

4th. The "nature" or quality of the material is practically restored entirely, if the plates are annealed.

5th. It is therefore desirable, though not essential, that all holes in the construction of the boiler should be drilled rather than punched.

6th. Owing to the early tendency to buckle in steel plates, special care is necessary in staying flat surfaces, especially where the plates are thin.—*Ironmonger.*

SQUARING OR FACING UP CAST IRON SURFACES.—A round end tool is best for this. A rough chip should be taken off, over the entire surface to be faced. Then speed your lathe up, and, taking a light chip, merely enough to take out the first tool mark, run over the entire surface again. In turning up surfaces it is always best to begin at the centre and feed out, as the tool cuts freer and will wear twice as long.

TO CHILL CAST IRON VERY HARD.—Use a liquid made as follows: soft water, 10 gallons; salt, 1 peck; oil vitriol, ½ pt.; saltpetre, ½ lb.; prussiate of potash, ½ lb.; cyanide of potash, ½ lb. Heat the iron a cherry-red and dip as usual, and if wanted harder, repeat the process.

CASE-HARDENING COMPOUND.—Prussiate of potash, 2 lbs.; sal-ammoniac, 2 lbs.; bone dust, 2 lbs.

Special Pulley Lathe.

Notable among the most novel Machinists' Tools is a special lathe for turning pulleys, manufactured by the Niles Tool Works, of Hamilton, Ohio. It is designed solely for the purpose of turning pulleys, bevel and miter gears, rolls, or any work of that character. And we learn, from those who have seen it in operation, that it performs its duties in an admirable manner. It is an entirely new departure, and we may call it a perfect illustration of the means being adapted to the end. We know of no other tool, designed to do this work, that can lay claim to any originality, being simply modifications of the ordinary lathe; whereas, this machine comes forward without much similarity to its predecessors as a claimant for popular favor, and is certainly well worthy of it. The principal features of its construction may be recited as follows: A cone pulley with six (6) steps transmits the power through tangent gearing to the main spindle; this is an extraordinarily steady and powerful method of driving, and is held in high estimation in England where it has been tested through a range of work that demands the utmost steadiness. Such as cylinder boring, &c. In turning over instance, should we require to turn a 30-inch pulley we would look for the step of the cone bearing this figure, and put the belt on it. This plan confines the operator to running the machine at speeds which experience has taught to be the best for each diameter. With the purpose of reducing the cost of finishing pulleys to the smallest possible amount, the Niles Tool Works have also designed and built a "Pulley Borer." It has many distinctive points to recommend it, and is a very efficient companion machine of the Pulley Turning Lathe; together these machines are said to be able to bore and turn six (6) 48" pulleys, 6" face, in a day of ten hours. For further particulars apply to the Niles Tool Works, Hamilton, Ohio.

Machinery Notes.

Machine screws are in good demand.

There is likely to be an advance in boiler material.

Machinists should take pride in caring for their tools, but not be too fond of the tap.

Many old boilers are for sale. The shells make good water flumes.

A new cow milking machine is out. Its operation is very simple. One man stands at the cow's head with a club, another at the tail holding a rope attached to her off hind leg, while a third man couples the machine to the source of supply. Then all three chant in chorus, "So-o-o-o you huzzy."

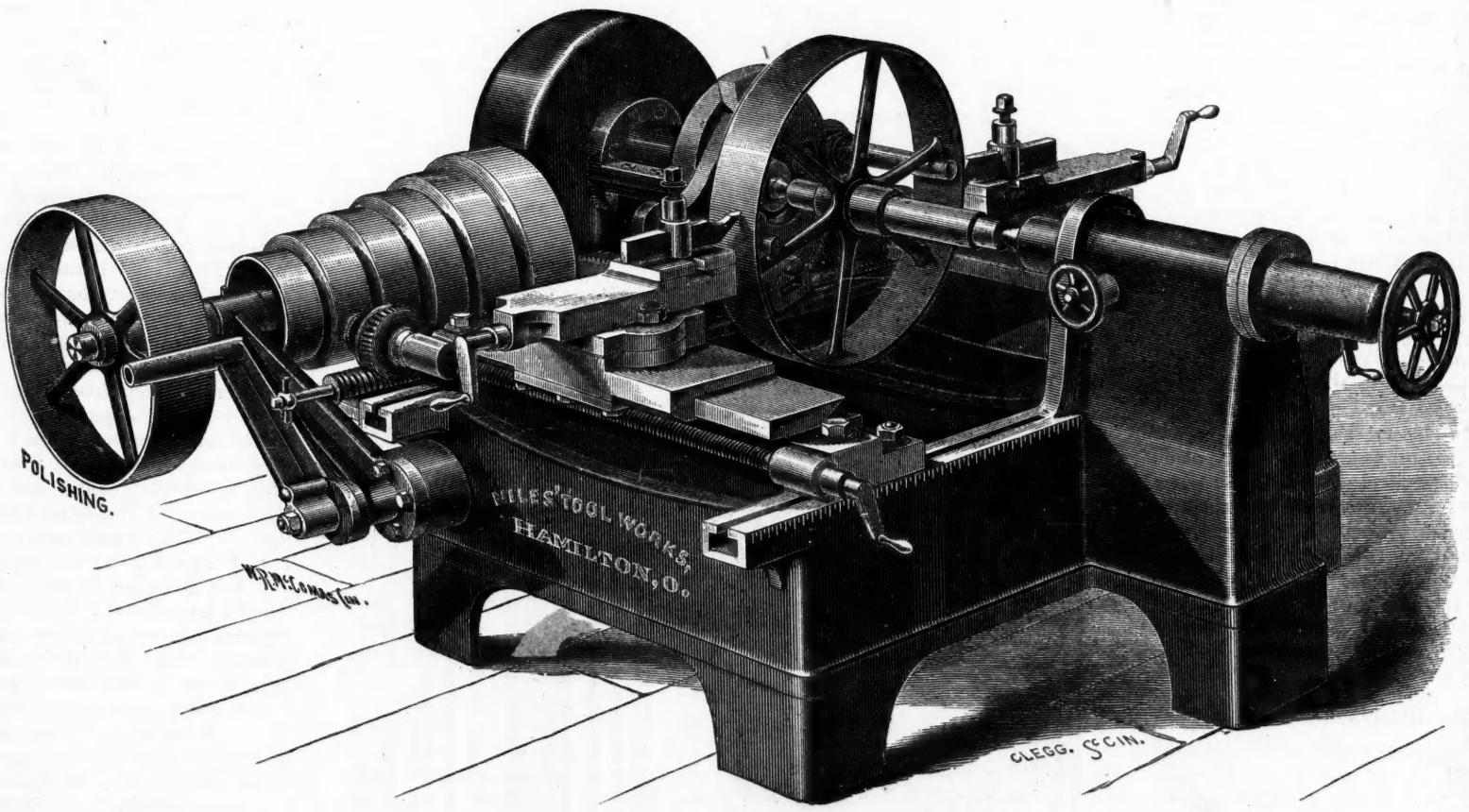
The Bureau of Statistics has issued an official statement of the exports and imports of the United States for the month ending April 30, 1878, and for the ten months ending the same date. The total exports for April were $59,959,082, and the imports, $35,448,011, being an excess of exports of $24,511,071, while the excess of exports for the whole ten months amounted to $227,625,441. This is certainly a favorable exhibit, and when business becomes generally active a large increase both in exports and imports may be expected.

PLANING PERPENDICULARLY.—In planing perpendicularly, it is necessary to swivel the bottom of the small head around, so it will stand about three-fourths of an inch inside of square, towards the piece you are to plane. This prevents breaking the tool when the bed runs back.

TO MAKE IRON TAKE A BRIGHT POLISH LIKE STEEL.—Pulverize and dissolve the following articles in 1 quart hot water: blue vitriol, 1 oz.; borax, 1 oz.; prussiate of potash, 1 oz.; charcoal, 1 oz.; salt, ½ pint; then add 1 gal. linseed oil, mix well, bring your iron or steel to the proper heat and cool in the solution. It is said the manufacturers of the Judson governor paid $100 for this receipt, the object being to case-harden iron so that it would take a bright polish like steel.

FOR MALLEABLE IRON.—Put the articles in an iron box, and stratify them among animal carbon, that is, pieces of horns, hoofs, skins, or leather, just sufficiently burned to be reduced to powder. Lute the box with equal parts of sand and clay; then place it in the fire, and keep at a light red heat for a length of time proportioned to the depth of steel required, when the contents of the box are emptied into water.

The prospect for the subscription to the new Barker mill (at Auburn) stock is good. One gentleman will probably take $50,000 of the stock, another $25,000, and others smaller amounts.



SPECIAL PULLY LATHE.

terstices, such as is presented to a tool on the circumference of a mortise wheel, the steadiness of action is very noticeable. There is no jumping movement as in the ordinary lathe when the tool is relieved from the cut and the opening or mortise is passing. This case is instanced as being one of the most trying to which a machine can be subjected, and if it shows no weakness under this test it is safe to assume great steadiness and absence of vibration under all circumstances. The driving-plate is of the equalizing type. The driving power is distributed uniformly throughout the pulley, and unequal and lateral strains are obviated. On each side of the solid bed-piece is placed tool-rests, which slide in and out on graduated surfaces to suit the diameter of pulley to be turned; they can be set angularly to get any degree of crowning. Tools are thus operated on both sides of the machine; the automatic feeds are continuous, not intermittent, and can be instantly engaged, disengaged or changed. Another feature of this machine is that the spindle of the cone pulley runs at so much higher velocity than the main spindle that its speed is suitable for polishing when the latter is turning. This arrangement secures a combination of machines. Each step of the cone pulley has stamped on its face the diameter of pulley or other work it is intended should be turned with the belt on it. For

What was the last mechanical job Adam did in the Garden of Eden? He bolted.

Columbus was the first iron founder in America. He cast an anchor.

A machinist is not necessarily wicked because he has a number of prominent vices.

Machines can now be made at an average of 25 to 30 per cent. less than before the war.

Engine and other cylinders bored without beeing removed, is the sign of an up-town machine shop.

A new comb machine has been designed by a down-East mechanic. It makes combs that are "up to the scratch."

Won't Professor somebody make another investigation of the Keely Motor? Some of our scientific exchanges are getting dry on the subject.

A Newark mechanic has constructed an electrical machine, which is said to develop great power. It is probably run by Jersey lightning.

M. B. Tidey, of Newark, makes some very neat wood-working machines. One of them is a Double-Compound Adjustable Cutting-off and Dadoing machine, and his circular states that it "finishes the work at one operation."

TO RESTORE BURNT CAST STEEL.—Borax, 1½ lbs.; sal-ammonica, ½ lb.; prussiate of potash, ½ lb.; resin, 1 oz. Pound the above fine, add a gill each of water and alcohol, and boil all to a stiff paste in an iron kettle. Do not boil too long, or it will become hard when cool. The burnt steel is dipped while quite hot in the composition, and slightly hammered.

BORING HOLES WITH BORING ARBOR.—A boring arbor is a shaft with a set in it, for the purpose of boring holes of great length, and is designed to be used in a lathe. In doing this properly, you must first see if your lathe is set straight; if not adjust it. Having done this, put the piece of work to be bored in the carriage of your lathe, pass your arbor through the hole to be bored, and put it on the centres of your lathe. Having done this, adjust your work true to the position desired by measuring from the point of the tool, continually turning round the arbor from side to side of the piece to be bored, while you are bolting it to the carriage, and measure until it is perfectly true. Having done this, bore the hole, and take for the last chip only a hundredth of an inch. This makes a true, and smooth hole. It is impossible to make a hole true with any kind of a tool when you are cutting a large chip, for the tool springs so that no dependence can be placed upon it.

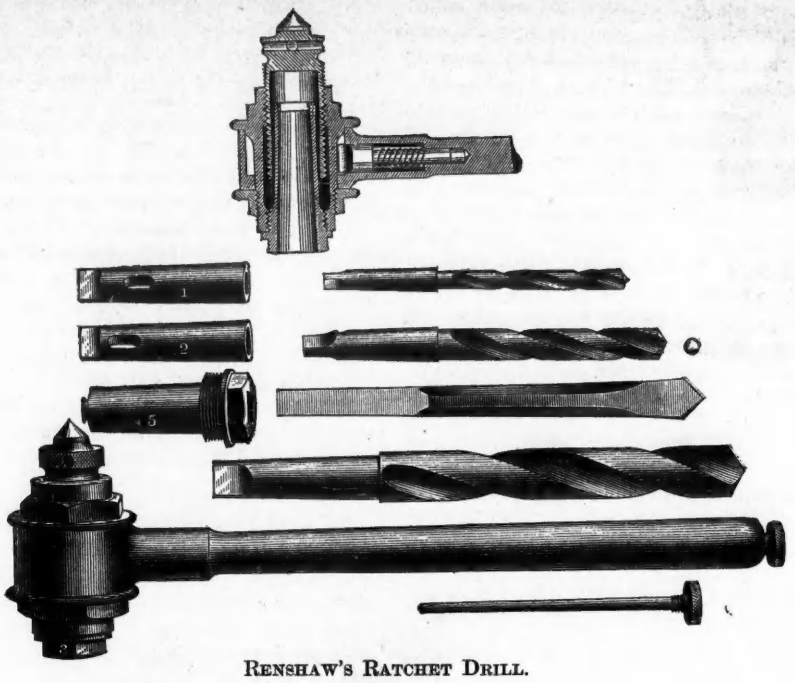
TO CAST BRASS SOLID.—The metal should not be run any hotter than is necessary to insure sharp castings. The most probable cause of the honey-combings of castings is that the air cannot get out of the way; and there ought to be proper vents made for it from the highest parts of the mould; the metal should be run in near or at the bottom of the mould. If about 1 lb. of lead be added to every 16 lbs. of old brass, when just at the melting point, solid good brasses will be the result. In melting old brass, the zinc, or lead, contained in it (when fluid) oxydizes freely, consequently the proportions of the metals are altered, and require an addition similar to the above. If the brass has not been re-cast a little less lead will do but if recast several times it may take the full quantity.

BORING A HOLE WITH A BORING TOOL.—In boring a hole with a boring tool, it is usually necessary to drill the hole first, and too much care cannot be taken in finishing. An iron gauge should be made first; it is usually made of a piece of sheet iron or wire. The hole should then be drilled smaller than the size desired, and then bored to the required size, and it is impossible to bore a hole perfect without taking two or three light chips, mere scrapings with which to finish. Holes, in this way, may be bored as nicely as they can be reamed.

Renshaw's Ratchet Drill.

The engraving represents a new ratchet drill manufactured by the Pratt & Whitney Co., Hartford, Conn., which is adapted to all the uses for which the ratchet drill is required, and which possesses some advantages over any others in the market. One of these is that the ratchet and pawl are perfectly protected from dirt, chips and dust, being inclosed in a case; another is the use of a hollow feed screw into which the shank socket passes, thus greatly reducing the distance between the centre point on the top of the screw and the bottom of the socket; and others are the reversibility of the action from right-handed to left-handed, the use of sockets for round and square shanked drills, these securing the large sockets by screw thread, and the accompaniment of a feed rod as part of the tool.

The engravings are sufficiently illustrative to be understood by a simple reference to them. The drill is shown entire in perspective and in vertical section, and in sockets and specimens of drills for which they are fitted, together with the feed rod attached, are also exhibited. The handle of No. 3 (shown in the engraving) is only 15 inches long, made of drop-forged wrought iron. The ratchet and spindle are of one piece of steel, and the feed screw and pawl are also of steel, nicely tempered to prevent wear. Between the tops of the screw and the bottom of the drill shank are only 5 inches, specially adapting this drill for the use of boiler makers and others who are compelled to work in a contracted space. The positions of feed screw and shank collet may be reversed, when the tool may be used *left-handed*. Four sockets are sent with each drill. Nos. 2 and 3, as marked in the engravings, have holes corresponding with the shanks of the Morse twist drills from ¼ to 1¼ diameter, the shanks also corresponding in size and taper with the Morse standard. The shanks of Nos. 1 and 2 also fit the No. 3 socket. No. 5 socket has a hole to receive square shank drills from ¼ to 1½ inches diameter, and is secured in the spindle by screw thread. Socket-wrenches or screw-drivers may be fitted to the drill. It is a tool well adapted to the boiler maker, iron bridge-builder, steam fitter, for use on board steam vessels, in the shop, in making connections with street gas and water mains, and in many other situations.



RENSHAW'S RATCHET DRILL.

Combination Die Plate and Pipe Cutter.

The accompanying illustration represents a very useful convenient hand tool for cutting pipe and holding dies for threading, first brought out two years ago, and lately improved in one or two particulars. It is equally efficient either as a die holder or a pipe cutter, as the separate tools, and is specially adapted to use in factories where they do their own pipe fitting.

The cutting-off attachment is very simple in its arrangement and working. Being contained in the handle, there are no outside wheels or screws to get out of order or broken from rough usage. The parts are protected against the admission of dirt and chips, thus always working freely.

The cutting tool does not simply separate the pipe, but cuts it, taking out a regular chip or shaving, leaving the orifice of the tube its full diameter, and raising no burr upon the outside. The thread can, therefore, be cut without the use of a file, causing a considerable saving of time, besides the expense of files.

The cover lifts up and is secured by a regular hinge; this is a great improvement upon the swinging cover, held by means of screws, which frequently work loose and are lost.

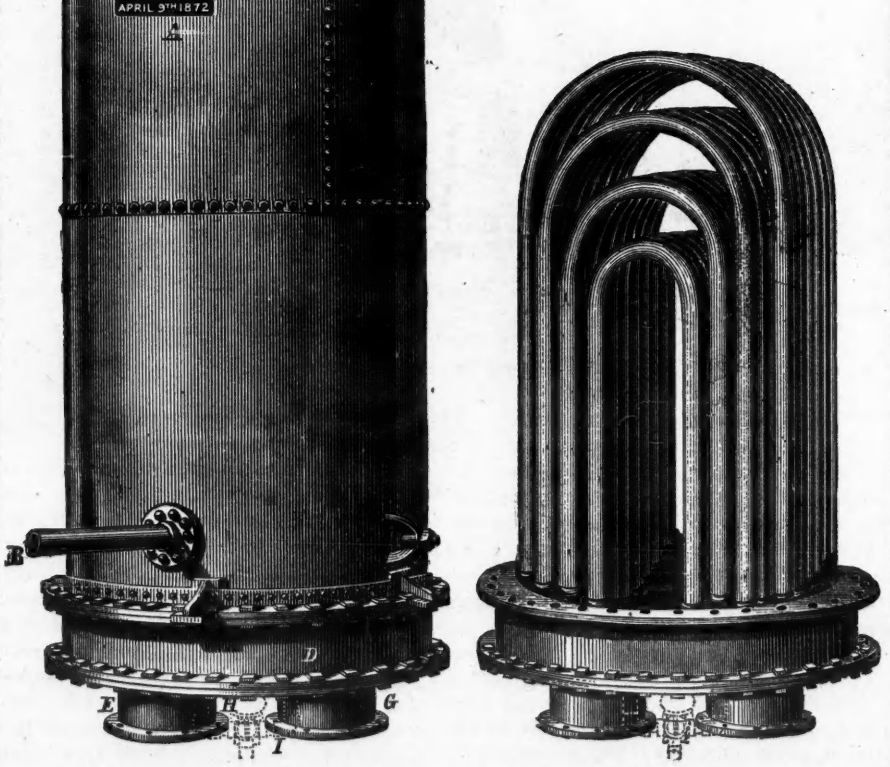
To transform the tool into a cutter does not require any alteration of parts. Simply substitute the guide block for the die, placing a bushing or guide of proper size in the back of stock, insert the pipe; bring the sliding steel jaw up hard against the pipe by turning the handle opposite the cutter. The pipe is thus firmly held without depending upon the knife for a bearing, by a simple arrangement, the knife is brought to the pipe instantly; turn the lugs to the right in cutting; take a light cut at first, use oil freely. A few turns suffice to cut through. The length of the handles afford sufficient leverage to render the operation an easy task. To cut the thread, merely draw back the knife and substitute the die for the block.

The facility with which the knife can be removed for sharpening, is a great advantage over any other cutters using the same style of cutting tool. No wrench or screw driver is required. It is only required to hold fast the lugs and unscrew the handle, or unscrew the cap; it can be replaced with equal facility. The knife passes into its socket without adjusting.

In the absence of a grind or oil stone, the knife may be sharpened upon any ordinary stone.

Should the knife wear out or become broken, any blacksmith can readily forge another. The only part of the tool liable to wear is the sliding jaw, which is made of steel, and hardened. Should any of the parts get lost, they can be readily replaced, as all parts are made interchangeable.

The manufacturers are Jamer, Jacobs & Co., 84 John Street, New York.

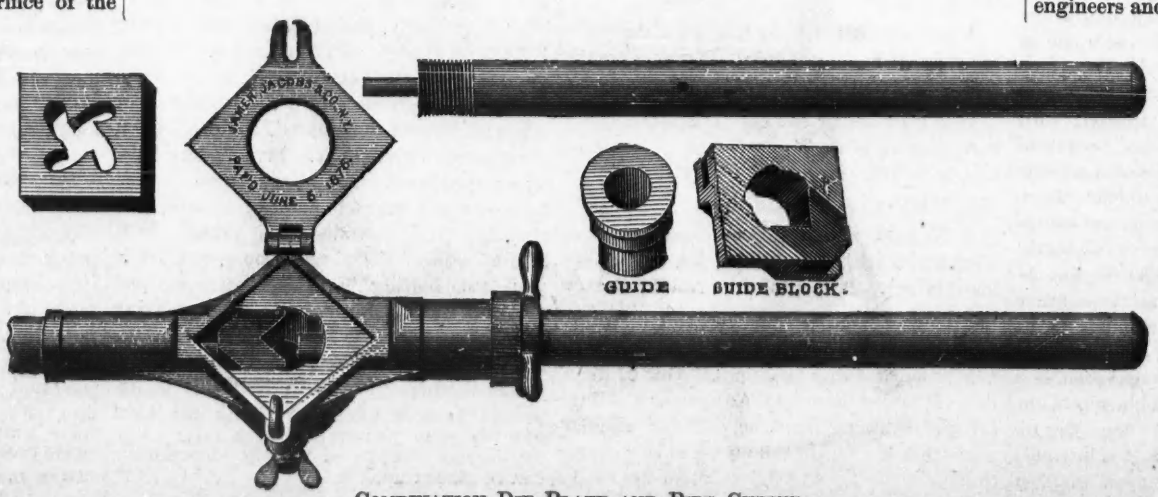


THE BERRYMAN PATENT FEED WATER HEATER AND PURIFIER.

The Berryman Feed Water Heater.

Among engineers and steam users there is a very general belief that there can be no advantageous use of exhaust steam in connection with a condenser. The accompanying cut represents the Berryman Patent Feed Water Heater and Purifier. By its use the manufacturer claims that a saving of seven per cent. is made in fuel consumption when boilers are fed from the hot water, and thirteen per cent. when they are fed with cold water, as is always done when the injection water is salt. The purifying results are not perfect when connected to a condensing engine, because the exhaust strain in the vacuum is but 163½° Fahr., and will not raise the feed water in the heater above 160° Fahr. To get perfect purifying results the water must be raised to a temperature of at least 186° Fahr., and not raised to boiling point. The Berryman Heater and Purifier has been in use in all sections of the country for the past eight years, with the most perfect success, both as a heater and purifier.

The several attempts to procure a machine "to work equally as well as the Berryman" is the best testimony of the perfect working of the Berryman. One particular point is to produce purifying results, which is an important feature to be relied upon in the Berryman. It also gives the highest fuel-saving results that can be obtained by the use of exhaust steam. It is made of the best material and workmanship, and the manufacturer guarantees every machine, both as a heater and purifier, to do all he claims for it. It is made in the United States only, by I. B. Davis, Hartford, Conn., to whom all communications should be addressed.

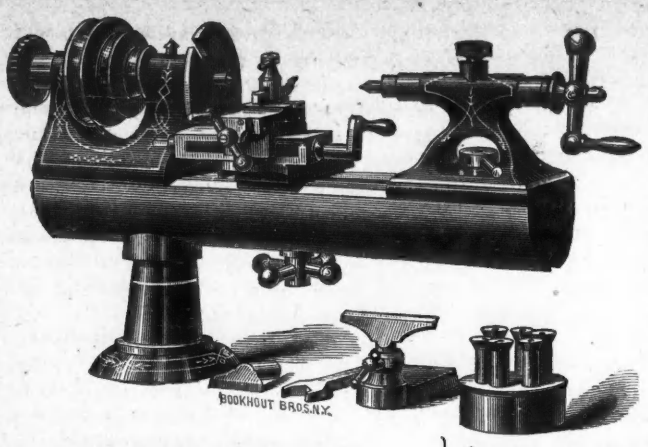


COMBINATION DIE PLATE AND PIPE CUTTER.

Publications Received.

ARCHITECTURAL IRON WORK.—A practical work for iron workers, architects and engineers and all whose trade, profession, or business connects them with architectural iron work; showing the organization mechanical, and financial management of a foundry and shops for the manufacture of iron work for buildings, with specifications of iron work, useful tables and valuable suggestions for the successful conduct of the business. By Wm. J. Fryer, Jr., John Wiley & Sons, New York.

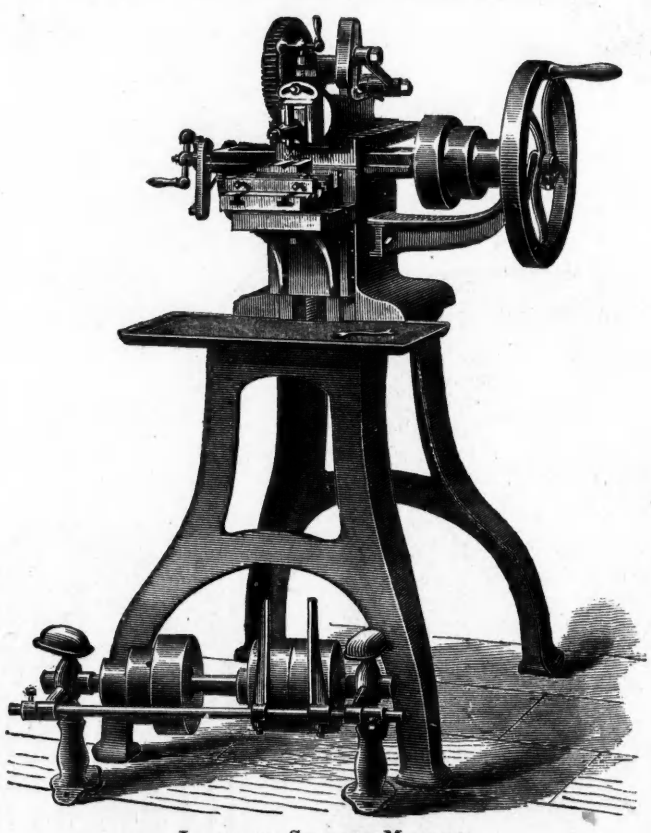
An illustrated volume of 220 pages, having the above title is before us. It is a very comprehensive work of its kind and the contents are systematically arranged. The author evidently understands the subject he treats upon, and is clear and concise in his statement of facts. Copious tables make the work valuable for reference.



New Hollow Spindle Lathe.

Cut represents an improved hollow spindle lathe, especially designed for jewellers, dentists, and model-makers. These lathes have tapered bearings, and are provided with an adjustment to take up any looseness occasioned by wear. They are made in the most thorough manner, and every part is gauged to standard size, and made in every way perfect. The heads, and all parts liable to strain, are made extra heavy. They have sold these tools to parties who use them on far heavier work than they are warranted to stand, but show scarcely any wear. The spring chuck is wholly unknown in some localities, and if its usefulness were thoroughly known and appreciated in shops where small and fine work is done, none would be without at least one lathe of this class in the shop. It may not be known that this chuck is one of the most important tools in all our watch factories where small shafts, discs, wheels, and pivoted work are transferred from tool to tool and in each held by the vise-like grip of the spring chuck, holding the work firmly and perfectly true without marring the surfaces of the shafts or points of the wheel-teeth, and enabling the workman to drill, turn or square, with unerring accuracy. Any mechanic knows how much bother and expense it incurred, when he has any small disc, screw-collar, or shaft all made and wants to get it back into the lathe true, to make some slight alteration. The center holes had to be turned off, perhaps; and unless the outside of the collar was turned at the same chucking as when the hole was drilled, the hole runs out. No scroll chuck is, or will remain, true enough for accurate work; so the workman has to get a piece of stock of some kind and screw it up as hard as he can in a scroll or independent jawed chuck, and carefully turn out a hole or recess to fit the shaft or disc, as the case may be. He may make a misfit, and if he is sucessful, the first time trying, in completing the work he will have used much more time than any one cares to pay for; and how hard it is to convince even the inexperienced customer that it "took all that time to do that little job!" The spring chuck grips the shaft or disc firmly, accurately and *instantly*. He don't have to get a piece of chalk and a hammer, and bend and bring the T rest up a few scores of times to find how much too hard he hit the last time. The spring chuck is made with a long cylindrical crank, the end holding the work being conical and resting in a seat of the same form, recessed into the steel spindle of the lathe-head. A thread being cut on the outside of the shank, through the hollow spindle, at the back end, is inserted another hollow spindle, or draw-in sleeve, in the end of which is a thread corresponding with the thread on the shank of the chuck. The draw sleeve is provided with a hand wheel and shoulders on the back end of the spindle. The chuck is sawed open far enough back from the conical end to allow the sections formed by sawing to spring together freely. A small pin projecting inside the spindle of the lathe and resting in a groove cut in the chuck shank, prevents the chuck from turning in the spindle. Now by turning the hand-wheel, the sleeve draws the spring chuck into its conical seat—closing on all sides equally—and allowing it to open when the sleeve is unscrewed. The chucks are made either with steps or shallow recesses turned into the outer face—to grasp discs or thin plates and wheels—several sizes being turned in the same chuck, thus giving it the name by which it is commonly known, "step chuck," or bored with a plain straight hole to wire sizes, and called "plain chucks."

For economy the larger plain chucks are also stepped. Stone & Hazelton make these chucks of any size, from the smallest practical diameter up to ¼ inch for this size lathe. The lathe is made to swing 5 inches, with bed 14 inches long. They can furnish a longer bed if desired. A slide rest of very strong and handsome construction is also furnished. Parties ordering lathes can have their chucks made to fit just the sizes of stock used.



IMPROVED SHAPING MACHING.

Improved Shaping Machine.

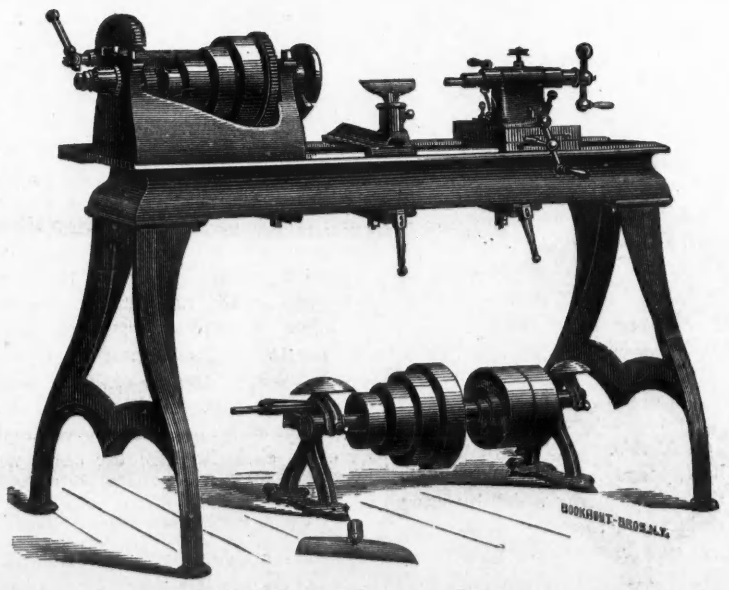
The cut herewith shows a carefully designed and well made power-shaping machine, manufactured by E. N. Boynton, Worcester, Mass. The extensive demand for a light, serviceable and low priced machine of this kind has been well met by him. The packings, driving shaft and feed screws are of steel. The surfaces of the sliding parts are all scraped so as to fit well. When necessary the screws and other parts are case hardened. The head is indexed for planing bevels, and the machine will carry a heavy chip. Its weight, including counter shaft, is 350 pounds. When desired a pair of centres go with the shaper, which will be found very useful in fluting reamers, taps, &c. One style of the machine is made to run by hand. It has a stroke of six inches and may readily be adjusted to work of any less distance.

There is lately considerable increase of activity in building railroad cars and locomotives. Railroad business is better, and rates for East bound freights have advanced.

The Phœnix Iron Company have secured the contract for the rebuilding of the Lebanon Valley railroad bridge at Reading, which was destroyed by the labor riots last July. It wil be of iron, have four spans 155 feet each; for a double track, to contain three trusses; 10 feet centre and 19 feet depth. Its test per lineal foot will be live loads of 93,000 pounds, followed by locomotives of 6000 pounds. The work upon the structure has already begun, and it must be finished in between two and three months.

New Brass Finishers Lathe.

The brass finishers' lathe shown in the cut, is made from new patterns throughout. It is a well designed, strong and neatly finished tool, calculated to meet the requirements of brass shops in every essential particular. It is made with hardened taper, spindle and boxes, with the dove-tail set over and with swivel and back motions on the tail stock. The cut represents a lathe to swing 14 inches with five foot feed. Other sizes are to be made with and without the chasing apparatus. The manufacturers are A. F. Prentice & Co., Worcester, Mass.



NEW BRASS FINISHING LATHE.

He Couldn't Stop.

Al. Barker was prowling around the locomotive machine shop, the other day, and noticing Tom Bexon and Anton Rossler taking turns at the crank in boring out a cylinder, was very anxious to relieve them for a few moments, "just to see how it went;" but Tom, with becoming gravity, told him that the crank must be steadily turned without an instant cessation or the work would be spoiled. Al. still begged to be allowed to try it, and finally seated him at the task, while he and Anton perched themselves upon a friendly bench and quietly chuckled as they watched the perspiration starting from the manly brow of their victim. Barker soon tired of the work and wanted to be relieved, but was told by Tom that he must finish the job, and not let the machine stop or the cylinder would be ruined, and having exhausted his persuasive powers upon Bexon he appealed to Anton, who simply responded, "It's better wot you keep 'em turning, Meester Barker—you once let's 'em stop somedimes und you spoil 'em sure!" Al. fumed and fretted and foamed and begged, and turned away for dear life, and ground out all the fancy cuss words in his vocabulary, until it suddenly occurred to him that he was being victimized, when his fingers relaxed from the crank and he stalked out of the shop with the air of a man who considered that he had been basely deceived.—*Aurora (Ill.) Beacon.*

Simplicity in Design.

Next to good fitting, there is nothing which tends so much to the good repute of a mechanic and his products as persistency in some simple form or style in the finish and ornamentation of his work. If the work be a machine, all of the visible shaft, bolt, stud, and nut-endings should be turned or milled carefully to the same general shape or form. There is nothing so neat and appropriate as the simple reverse curve style, free from corner or bead. Inward corners should always be avoided. There is nothing so discouraging in machine-cleaning as complicated beadings or complex mouldings; they are, as in house-cleaning, only dirt-catchers, void of beauty. It is no light task to keep a complex machine like the railway engine clean and tidy; the finish and ornamentation of such machines should, by all means, be made as simple as possible. Neatness and utility should be the only objects in their construction, and all elaboration in the way of show should be avoided. The propriety of using so much brass in the external finish of locomotives has been questioned; it tarnishes so easily that an almost continual rubbing is necessary to keep it bright, imposing a tremendous tax on patience and muscle. Paint and varnish judiciously applied occasionally, especially to all the large surfaces, such as cylinder and steam-chest casings, would be far more neat, economical, and satisfactory. — *National Car Builder*

The editor of a scientific paper, in order to ascertain whether the wheels of machinery do not run faster at night than in the daytime, went and made an investigation with a speed indicator, and publishes an article giving as the result of his trial the information that there is no difference in velocity; the wheels run no faster by night than by day. We are glad to see this question thus authoritatively settled, but another of like nature arises to puzzle some other scientific minds. When machinery is run every day regularly, do not the wheels run faster on Sunday than on week days?

Thompson, Epping & Carpenter, Pittsburgh, of the Keystone Steam Pump Works, have been awarded the contract for two pumps for the new Butler water works. These pumps will have 20-inch steam cylinders, 10-inch water cylinders and 36-inch stroke, and will throw over 25,000 gallons each, per hour. They weigh nine tons each, and are somewhat larger than the pumps at the Kittanning water works, made by the same firm.

A Suggestion for a New Source of Power.

When two gases are separated by a porous diaphragm, as of plaster, plumbago, or paper coated with a film of collodion, they at once begin to pass through this diaphragm in both directions and finally become as intimately mixed as though there were nothing to separate them. This is a property belonging to all gases and is known as diffusion. Some gases pass through a porous membrane much more quickly than others, but there is a simple law which governs this action known as the law of diffusion. We will state this law further on when it will be more intelligible; but first let us look into the mechanism of the phenomenon.

Conceive all gases to consist of spherical particles of a size appreciable to the senses, in fact, such a conception is absolutely necessary to enable us to fully understand the phenomena with which the physicist has to deal. Let these particles be constantly in motion, bounding back and forth against the sides of the vessel containing them, and we have before our minds the idea of a gas, the ultimate molecules of which are constantly moving under the effect of heat. The force with which the molecules strike against the sides of the vessel determines the pressure of the gas according to the kinetic theory, which is now almost universally accepted.

Let us now take a cylinder with a piston in the middle, capable of being moved in either direction, but at first secured, and fill one side of the cylinder with hydrogen gas and the other side with oxygen. Considering the molecules magnified to appreciable dimensions, we see them pounding against the sides of the cylinder and piston, and, on counting them, we would learn that there are the same number of molecules of oxygen as of hydrogen. If we release the piston it does not move, showing that there is no excess of pressure on either side. But the hydrogen is sixteen times lighter than the oxygen, and since the number of molecules in a given volume of the two gases is the same, and since we find an equality in pressure on both sides of the piston, we must conclude, by a very simple process of reasoning, that the equal energy of the two gases is only obtained by a greater velocity in the motion of the lighter molecules. In fact, the hydrogen molecules move with four times the velocity of those of oxygen. In considering the phenomena of gaseous molecular motion we have two elements, equality of energy with difference in velocity. The question at once arises, Can we utilize this difference in velocity in the production of motion in masses? For much that is here written we are indebted to Mr. S. Tolver Preston, who has recently contributed some admirable articles on this subject to *Nature*.

Let our piston now be fixed, and suppose it pierced with numerous holes, just large enough to allow of the passage of the gaseous molecules Under these circumstances, the gaseous molecules will now and then encounter the vacant spaces and pass quite through the piston. Since the hydrogen particles move with four times the velocity of the oxygen, they will pass through the holes with four times the frequency, and consequently the pressure on the oxygen side will rise, and this increase of pressure will be due entirely to the *velocity* of the hydrogen molecules and not from any additional *energy* they may be presumed to have. This excess of pressure may be used to produce external work, but before we carry on our experiment any farther let us see if there is any law in Physics that has a bearing here.

The second law of thermo-dynamics, as given by Deschanel, reads as follows: "The efficiency of a completely reversible engine depends only on the temperature at which the engine takes in and gives out heat; and the efficiency of such an engine is the limit of possible efficiency for any engine." In other words, there must be a difference in temperature or no work can be performed. In our experiment, however, we have capacity for work with no change of temperature. This law was framed without considering the distinction between energy and velocity of molecular motion, which we have made available. It follows also from this law that a warm body cannot extract heat from a colder or from one of the same temperature. Returning to our experiment, let us release the piston at the moment the pressure reaches its maximum. The pressure causes it to move until equilibrium is restored but note the effect. We know that when a gas expands it becomes colder. The oxygen in forcing the piston becomes colder than surrounding objects, and the hydrogen being compressed becomes warmer, and, what is a more novel circumstance than any other with which we are acquainted, the hydrogen is warmed at the expense of the colder oxygen, for, the instant the piston begins to move, the oxygen is already colder than surrounding objects, and as the motion continues the hydrogen grows warmer as the oxygen becomes colder.

To demonstrate these facts experimentally, it is only necessary to use a piston of some porous material like plaster or plumbago, which will allow the passage of molecules, as did our imaginary holes the magnified particles. We find hence that the law of thermo-dynamics, quoted above, no longer holds as a law in physics, and it has been known to be not universal for some time. In science, no law can have an exception.

An apparatus may be constructed upon the principles above given which is capable of converting molecular (heat) motion into external work, and which will act continuously.

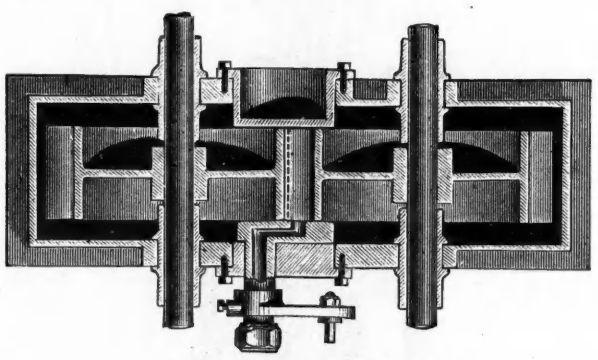
By our conception of molecular motion as given by spheres of appreciable size, we are able to understand the mechanics of diffusion through a porous membrane, and, at the same time to see the reason for the law which governs the rapidity of the action. This law is usually given by saying that the rates of diffusion of gases are inversely as the square roots of their molecular weights. Since we have seen that it merely depends upon the relative velocity of the molecules, we are able to understand the connection which lies between the molecular weights and the rates of diffusion. Heretofore we have only known the fact as given in our text books.

It is, perhaps, too early for us to see the full import of all this. The sun, our great source of heat, pours down upon us every day a vast amount of energy which inventors have long endeavored to utilize as a source of mechanical power. We are accustomed to look upon it merely as a source of heat which can be concentrated and used to boil water and produce steam. But now, when we have a glimpse of the store of molecular energy there is continually surrounding us, and which we have already shown to be available as a source of power, our solar engines may not always depend upon a cloudless sun.

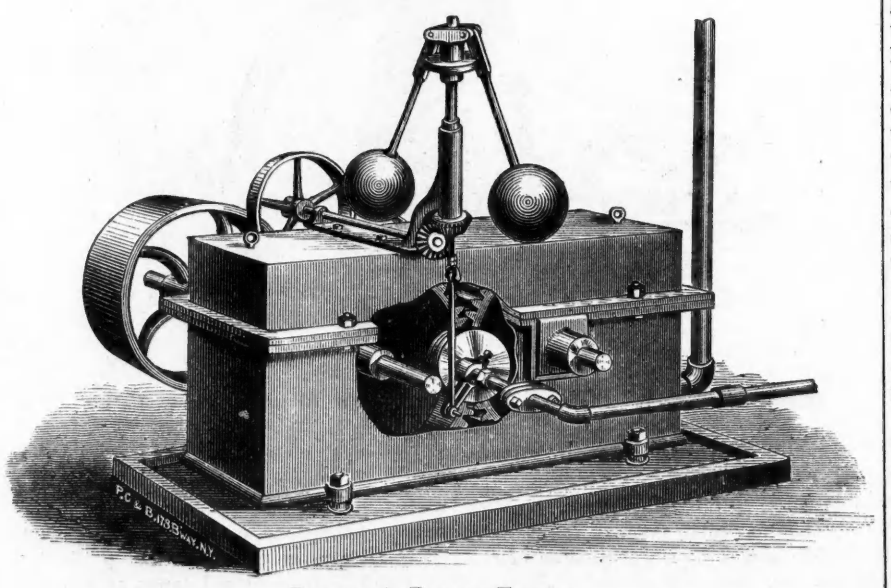
We cannot yet say that this source of power is capable of practical use; still, when we think of the great amount of this heat energy lost by radiation into space, it seems not impossible.

DRAW-FILING AND FINISHING.—To draw-file a piece of work smoothly and quickly, it is best to first draw-file it with a medium fine file, and finish with a superfine file. After doing this, polish the work with dry emery-paper, and then with emery-paper and oil.

SCALING CAST IRON.—Vitriol, 1 part; water, 2 parts; mix and lay on the diluted vitriol with a cloth in the from of a brush, enough to wet the surface well; after 8 or 10 hours, wash off with water, when the hard, scaly surface will be completely removed.



DUDGEON'S ROTARY ENGINE.



DUDGEON'S ROTARY ENGINE.

How to File Work in the Vise.

Few men that call themselves good workmen know how to file a piece of work in the vise. The most of them think that it is only necessary to run a file across the work in most any shape to have it done right. It is a nice job to file a piece of work true. In the first place, you must have the work held firmly, and have the part to be filed horizontal. You must have a good handle, and have it put on the file straight. Hold the file firmly, and do not shove it too fast, nor bear down when you draw the file back. Be sure and run the file straight across the work. You cannot make a good job nor file the work straight if you bear down on the file hard. Many persons will raise one hand and lower the other every time they make a stroke. This is all wrong, as the work will be round. You must keep the file clean, or the work will be scratched. If you wish to do a fine job, it will be found advantageous to oil the file or to chalk it; then the chips will not stick to the file.

The late accident on the East River Bridge, by which two men lost their lives, proves the necessity for more careful engineering.

Reports of the Judges of Awards, International Exhibition, 1876.

We are indebted to Messrs. J. B. Lippincott & Co., Philadelphia, for copies of the reports and awards, Groups XX and XXI of the Centennial Exhibition, now published and for sale by them, and from which we give some extracts below. In our issues of December, March and April, we gave copious extracts from the advance sheets of reports, Group XX, Motors, Hydraulic and Pneumatic Apparatus, &c., (written by Charles E. Emery, of New York, one of the judges), which with the exception of Group I, is the most fully reported upon of any of the 36 groups. The book contains 432 pages, fully illustrated. It embraces the results of exhaustive tests on steam boilers, steam fire engines, and turbine water wheels. The general report on Group XXI, Machine Tools for Metal, Wood and Stone, is the most disappointing of any we have seen. It contains but four pages, devoted to general commendation of the exhibits of different countries. The special reports on individual awards are fuller than in Group XX, though they seem calculated to bestow as much praise as possible on everything noticed. All the reports are now ready, and will be supplied by Messrs. Lippincott & Co.

We have selected the subjoined extracts because they convey some valuable information upon the subjects treated.

1. STATIONARY AND PORTABLE ENGINES.

For reasons previously mentioned, no attempt will be made to describe the distinguishing features of the large number of stationary and portable engines exhibited. A few have, however, been selected to illustrate the application of different types of valve-gear.

Engines regulated by the action of the governor on a throttle-valve operate under two important disadvantages: first, the regulation is not perfect, no matter how good the governor, for the reason that there must necessarily be considerable space between the throttle and main valves, which tends to retard the regulation by furnishing an additional supply of steam when the throttle is closing and absorbing a portion of the steam supplied as the throttle is opening; second, the initial pressure in the cylinder is diminished, which reduces the economy, as is well understood and shown by experiments referred to hereafter; the system, moreover, does not enable the benefits due to free expansion to be utilized.

The principal improvements which caused the high degree of efficiency of modern steam-engines for manufacturing purposes were initiated in the year 1849, by Mr. George H. Corliss, of Providence, Rhode Island, by the invention of his well-known cut-off, tripped automatically by the action of the governor so as to proportion accurately the supply of steam to the load to be overcome, and at the same time utilize, in the cylinder, substantially the full boiler pressure and expansive effect of the steam, and thereby secure economy in the use of steam and fuel.

The segmental valves, adopted by Mr. Corliss and known by his name, secured also the further economy due to the reduction of the area in cylinder passages to a minimum. The arrangement of the exhaust valves in the bottom of the cylinder secured still another advantage, which, strange to say, is not appreciated by all manufacturers—that the cylinder is not only cleared of water in starting, but, in regular working, a free exhaust in such position carries out most of the moisture in the steam due to the performance of work in the cylinder, and there is less to be re-evaporated by radiation from the walls of the cylinder which must be re-supplied during the next stroke, at the expense of the fuel. The success attending the improved mechanism of Mr. Corliss, and the business manner in which it was introduced, naturally gave an impetus to invention on the subject, and many engines with governor cut-offs were developed, though but few obtained a standing in the market. The main valves or independent cut-off valves were operated by cams, revolving eccentrics, and secondary

steam-cylinders, and many modifications of the trip cut-off were designed, but the latter did not go into general use while the original Corliss patent was in force.

* * * * * * *

2. Mr. Wm. Wright, now of Newburg, New York, at an early date designed a number of cut-offs, varied by the governor, in which, generally, horizontal poppet-valves were used, operated by a cam on a shaft geared to the main shaft; the adjustment of the cut-off being made by shifting position of the rear of the cam in various ways. In several modifications by Mr. Wright and others, the poppet-valves were arranged vertically, and in certain cases slide-valves in similar position were substituted, the valves of either kind being tripped to drop freely or lowered by an adjustable cam.

* * * * * * *

3. ROTARY ENGINES.

It may be safely stated that experienced engineers have little faith in rotary engines, of the well-known type, for the economical development of power. Much ingenuity has been expended upon the subject, but the difficulties of obtaining tight wearing surfaces are apparently insuperable. Such engines, however, offer advantages on account of their compactness and simplicity when economy of steam is of secondary importance. For instance, a small hoisting-engine used but little may as well be of this character, since, considering first cost and reliability under conditions of neglect, in connection with the quantities of steam used, it may prove more economical in the end than other forms. The rotary fire-engines illustrated in the fire-engine report, presented herewith, are also well adapted to their work, and have advantages peculiarly their own. A number of rotary engines of different forms were exhibited, but the only one believed to possess novel as well as exceptional features was that invented and exhibited by Richard Dudgeon, New York, a longitudinal section of which is shown in Fig. 62.* As in other forms of rotary engines, there are two spur-gears with long engaging teeth, but the steam is admitted at the side *between* the teeth, near the line joining the centres of wheels, and acts to separate the wheels on a line above or below their centres, thereby producing rotary motion. The case is not necessary to secure operation, as it contains only exhaust steam. Two plates on the side of the wheel where the teeth engage are all that are essential, steam being admitted through an opening in one of them. By shifting the plate containing the opening up and down, by hand or with a governor, the expansion may be varied to regulate speed, and by moving this opening the other side of the line joining the centres of the wheels, the engine will be reversed. An engine of this kind has been running for six years in New York with superior economy to the ordinary engine formerly employed, and is in as good condition as when first-started. Steam does not blow through, and there is a definite exhaust as each tooth is released.

* * * * * * *

4. STEAM-ENGINE INDICATORS.

The original form of the steam-engine indicator as invented by Watt, in which the steam-piston had the same movement as the pencil, was found inapplicable for use at high speeds on account of the momentum of the moving parts, which caused large vibrations of the pencil on the paper, and often serious jars with corresponding inaccuracies in the diagrams. In instruments on this plan it was necessary also to take hold of the pencil when in rapid vibration, in order to apply it to the paper. The first indicator adapted for high speeds was that used by Mr. Gooch, of England, for experiments with locomotives, in which the indicator piston was connected with the short arm of a lever and the pencil carried at the end of the long arm. This arrangement permitted the use of a stiffer spring, and reduced the vibrations within moderate limits. The objection was that the diagrams were distorted by the motion of the pencil in an arc of a circle, and particular care was required in measuring them.

In 1862 an important improvement was made by Mr. Charles B. Richards, of Hartford, Connecticut, who applied a simple parallel motion, in place of the single lever of the Gooch instrument, and thereby obtained the ordinary form of diagram with reduced movement of piston The levers were pivoted to a swinging arm, whereby the pencil could be moved up to the paper without handling vibrating parts. The Richards instrument finally came into general use to the practical exclusion of the old direct forms, and has proved of the highest value to engineers, assisting them in investigations for the purpose of improvement and enabling the performances of all kinds of engines to be satisfactorily compared.

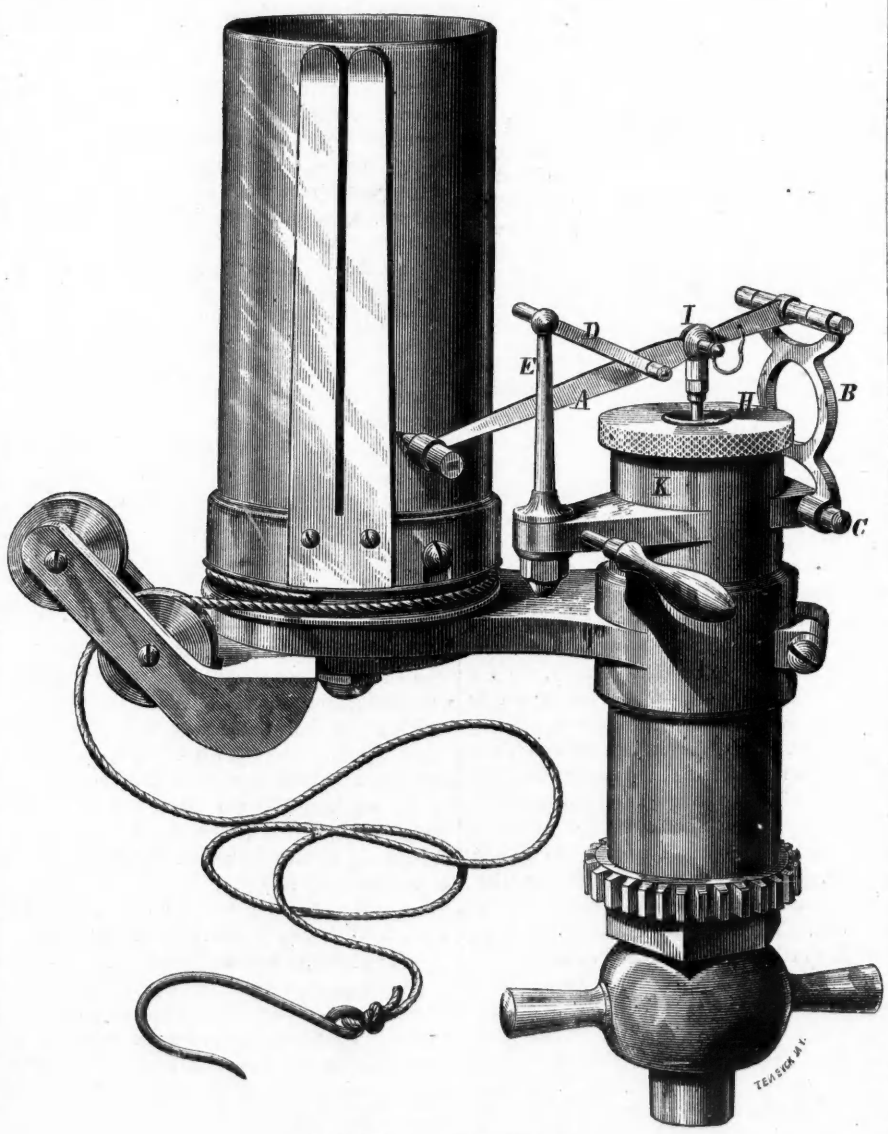
The Thompson indicator, exhibited by the Buckeye Steam-Engine Company, of Salem, Ohio, is a modified form of the parallel motion, or Richards indicator, in which a simpler form of parallel motion is used than that employed by Mr. Richards, as is clearly illustrated in Fig. 63. The construction still further reduces the momentum of the working parts without apparently introducing any objectionable features.

* In place of which we show two other cuts.

Reversing an Engine.

In our last issue we gave a method of reversing an engine which has called forth letters of protest from a number of our readers. The following is the approved way to reverse an engine: Place the engine on one of its dead centres, loosen the eccentric and move it in the direction the engine is to run, giving more or less lead, according to circumstances. A fast running engine will require more lead than one running slow. Next fasten the eccentric, and move to the opposte centre. Note and adjust the variations of lead.

A MARVELOUS PROPHESY.—Mr. W. D. Marvel, a broker in iron and rails, writes a letter to the *Coal Trade Journal*, in which he predicts and tries to show by statistical argument, that there will soon be a scarcity of rails both in this country and in Europe. "It is safe to predict," says he, "that steel rails during the next five years will aggregate $10 per ton higher than at the present time."



THE THOMPSON INDICATOR.

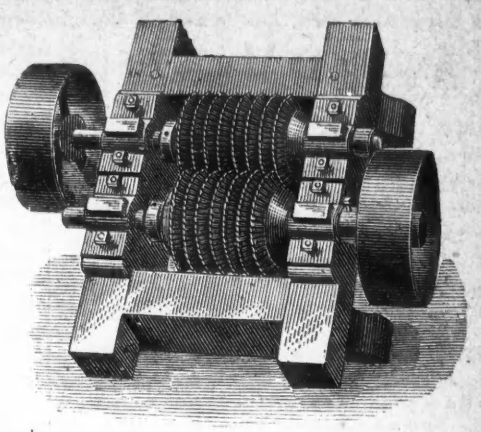
To Temper Steel.

Heat the steel slowly and turn it over often, so it will heat evenly; do not heat the steel over a good red heat. Plunge it in clear cold water. Be sure and hold it perpendicular, and don't move it sideways; by so doing it will cool evenly, and not be so apt to spring. For the most of tools it is best to keep it immersed in the water until perfectly cold. Rub the tool with sandstone or other article that will give it a bright surface, so you can see the color. Heat an iron, and hold the tool on the iron until the color comes to a straw shade, then cool it so it will run no lower. The hardness indicated by the above shade is suitable for most all kinds of turning tools for wood or metal. For cold chisels, let the color run lower, or to a light blue.

TO SOFTEN MALLEABLE IRON.—When your furnace is charged with fuel and metal, get the fire up to a dull red heat, then pour fluoric acid all over the coke; use ½ pt. or even 1 qt., adding a handful of fluor spar; it will make the metal much softer.

WATER ANNEALING.—Heat the steel to a red heat, and let it lie a few minutes, until nearly black hot; then throw it into soapsuds; steel in this way may be annealed softer than by putting it into the ashes of the forge.

SOAPSTONE AS A LUBRICANT.—A writer in one of the foreign technical journals expresses a decided preference for soapstone powder, in the form of dust, as a lubricant for the axles of machines. For this purpose, it is first reduced to a very fine powder, then washed to remove all gritty particles, then steeped for a short period in dilute muriatic acid, in which it is stirred until all particles of iron which it contains is dissolved. The powder is then washed in pure water again to remove all traces of acid, after which it is dried, and is the purified steatite powder used for lubrication. It is not used alone, but is mixed with oils and fats, in the proportion of about 35 per cent. of the powder added to paraffine, rape, or other oil—or, the powder may be mixed with any of the soapy compounds employed in the lubrication of heavy machinery.—*N. Y. Sun.*



Newell's Universal Grinder.

The extensive and varied uses of portable grinding mills have induced inventors to expend a great deal of effort in devising new styles and improvements in that class of machines. The one shown herewith is an entire new departure from any mill we have previously seen, and one that proves unusually successful in grinding many substances that have heretofore been very difficult to granulate or pulverize. In operation it does not *mash* grain, but *grinds* it by rapid abrasion which not only saves a great deal of time and labor, but insures a better quality of flour. The process does not heat the flour, which with a large part of the mills now in use is an insuperable objection. Even 200 bushels of corn can be ground every hour without danger of heating. In construction the grinding discs are made of chilled iron, or steel, with beveled edges locked together upon a shaft composing a cylinder with a series of angular indentures upon the sides of which are radial cutters, or teeth. Another shaft with duplicate discs is so placed that the projections on one cylinder fit into the spaces between the projection on the other. These cylinders revolve inward, one much more rapidly than the other. Wheat or other grain is perfectly pulverized without taking from the mill a particle of grit. The grinding discs can be easily and cheaply replaced when they become worn. The weight of the machines vary from 200 to 800 pounds; they are very compact and the frames are made either of wood or iron. It is claimed that this mill can be adapted to a greater variety of purposes than any other ever invented. It works with complete satisfaction iu the pulverizing of quartz, phosphates, zinc, bone, brimstone, chemicals, oyster shells, horn, South Carolina clay, chalk, cement, cork, wheat, corn and other grains, coffee, spices, loaf-sugar, mustard, rosin, emery and flax seed. It is claimed that it will grind quartz remarkably fine at the rate of ten tons a day. With one horse power it grinds twenty-five bushels of corn per hour for feed, and with four horse-power two hundred bushels per hour. Its usefulness to farmers is apparent. The machines are manufactured and sold by Newell & Chapin, foot of West Nineteenth Street, New York.

BALANCE WHEELS.—Every balance wheel should be speeded up so as to run twice or three times as fast as the crank shaft it is intended to balance. When a balance wheel is applied in this way it makes the machine run a great deal more steadily, for, when the balance wheel is geared into the crank shaft, and runs two or three times faster than the crank shaft, it forms a power of itself when going over the centre, which propels the crank shaft until it reaches the quarter, where it again takes its power from the machine. Although it takes an additional shaft and gears to apply a balance wheel in this way, the saving of metal in the balance wheel fully compensates for the extra labor; for, when a balance wheel is speeded three times as fast as the crank shaft, it needs only one-third of the metal in it that it would were it not speeded up at all, and if balance wheels were applied in this way generally it would make all engines run far more steadily.

The greatest improvements in Machine Tools now being made, are on upright Drills.

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CHARLES CHURCHILL & Co., 28 Wilson Street Finsbury, London, E. C., will receive and forward subscriptions and advertisements on our regular terms.

EDITORIAL ANNOUNCEMENT.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

NEW YORK, JUNE, 1878.

Announcement.

We take pleasure in announcing that we have completed arrangements with the American News Company whereby they, together with their branches, will supply newsdealers with the AMERICAN MACHINIST in any part of the United States and Canada promptly after its issue (on or before the 15th of each month). In order to more rapidly extend our circulation, we have reduced the subscription price to $1.00 a year, and single copies can be obtained from any news-stand at eight cents. We shall spare no effort to make the AMERICAN MACHINIST a worthy and progressive representative of the great machinery interests of this country.

Importance of the Machinist.

The machinist is certainly one of the most useful members of society. It would be very difficult to dispense with his services. Almost everything we eat, wear or have in our houses is in some way dependant upon the skill and labor of the machinist to make it what it is. The farmer puts in his seed and harvests his crop by the aid of labor-saving machinery. The grain is threshed, ground, and the flour made into bread by machines specially adapted to their purpose. Every fabric of dress, almost every piece of furniture, and all books and newspapers are produced by means of machinery. When any new article is to be manufactured, the machinist is called upon to design and construct mechanism for the purpose. If not an inventor himself, he is most essential to the inventor, for he must make the model (if an important one) used to secure the patent, and when applied to practice the machine to do the work. The work of the machinist is one especially requiring brain as well as muscle. Most other occupations do not demand so constant study after the details are once learned, but the machinist needs always to be on the alert to plan, originate and adapt means to accomplish particular results. Agriculture is lauded as one of the noblest occupations, but in its pursuit the part of the work is left to nature, while the machinist has to operate upon dormant matter from which to fashion objects that put in motion, run accurately and perform their work almost like things of life. If an occupation is noble because it administers in an important degree to the necessities of mankind, then that of the machinist is one of the noblest of all, for his aid is invoked either directly or indirectly in supplying nearly every necessity that can be mentioned. The machinist is more closely identified with the world's greatest progress than the author, the statesman, or the learned professor. When the real cause of the advanced position our country sustains is sought for, it will be found, not in the numerous colleges and universities, nor in the perfect freedom of the press, but in our *active, intelligent mechanics*; and the machinist is the chief among mechanics. The nations that stand highest in the scale of power, wealth, intelligence and influence, give the most attention to machinery. At the outbreak of our great civil war, the Southern chivalry set up a taunting cry about the "greasy mechanics" of the North, but when the conflict cut off from them every free source of outside supplies, the need of mechanics was most severely felt. From that time to this, good mechanics have been highly appreciated at the South; and there is to-day no other section of our country where they are more honored and respected.

A Direct Steal.

If any one will take the trouble to examine into the patents issued by the English Patent Office, they will find that about 50 per cent. of those having any practical value have been stolen directly from our inventors, without the slightest improvement or modification being added to them, and without the least mention being made by the applicant for the English patent, as to whether he was the first and original inventor or had any right to claim the invention as his own. Since the publication of the *Official Gazette*, of the United States Patent Office, was begun in 1872, quite a lively business has been done by these patent sharks, for it has enabled them to carry on this swindle at comparatively little cost. All they have to do is to subscribe for the *Gazette*, pick out such inventions as they wish to appropriate, and if the *Gazette* does not give a full enough description they send 25 cents for a complete specification of each one. There are parties in New York city who make a business of pirating over to England any new article that is likely to sell in the English market as soon as it makes its appearance here. They find the English manufacturers ready purchasers of any article of merit, for they know that it is much cheaper to manufacture an article that has been fully developed, than to originate, experiment and perfect one at a cost of thousands of dollars and years of time. Some manufacturers are smart enough to send for circulars, select the articles they wish to manufacture, send for a sample of each kind, and commence to make them at once. We know of a case where an American visiting England had his attention called to three English inventions of real merit, which were meeting with ready sale. He was tempted to purchase the right from the *alleged inventors* to apply for an American patent. On his return home he dreamt only of his income from these inventions, and his good fortune in purchasing them. Imagine his surprise when he arrived in New York to find that his articles had been patented here, and had been on the market over a year before they were pirated over to England. The New York *Sun*, whose microscopic eyes and microphonic ears are always open to discover anything like fraud, has called Prof. Edison's attention to the fact that the English professor has "stolen his thunder," or rather his microphonic whispers. It appears from an interview of a *Sun* reporter with Prof. Edison, that he accuses a Prof. Preece, of London, who visited his laboratory over a year ago, and to whom he fully and freely showed all his discoveries, with having deliberately and coolly stolen his microphone invention, and having communicated the idea to a Prof. Hughes, who now claims it as his discovery; and Preece has the cheek to deliver an address on his friend Hughes' wonderful microphonic invention. Prof. Edison offers positive proof from his patent, and articles published in scientific journals, that this is a direct steal. No wonder he should feel annoyed at it and declare, "Let 'em steal the microphone if they will; that is only one little thing. Before another two years' go by I'll give 'em phones and graphs enough to make 'em sick." We presume he refers to his terrifically sounding "megaphone," which will produce thunder enough for all creation to steal from, and still leave him a good supply on hand. When he gets his horn ready we will join him in the chorus.

Knowing All About It.

We often hear mechanics remark, "I know all about that! Nobody can teach me anything about that!" Now a fair amount of conceit is refreshing to observe, especially in mechanics, for their occupation is one that requires great independence of thought; but when it reaches downright stubbornness and chronic opposition to every idea new to them there is no hope of further progress, or even of keeping up to the times. Improvements and new adaptations of old and familiar principles are the order of the day, and when any mechanic thinks he is beyond them, his usefulness will steadily decline. It not unfrequently happens that old, experienced workmen, learn something valuable from apprentices, or from other sources where they would scarcely look for it. No one can expect to keep up to the times if he shuts his eyes to any source of valuable information, and nobody is so far advanced that he can not learn many things useful from those having less experience that himself.

Socialism—Communism.

The whole country is just now somewhat excited upon the question of socialism or communism, especially since the demonstrations recently made in St. Louis and other localities by organized bands of agitators rallying under the red flag. The danger to be apprehended from this element in our body politic has doubtless been greatly exaggerated by the daily press, yet it is not altogether groundless. The inquiry is naturally raised, who are communists and what do they aim to accomplish? The leaders will probably answer that they are workingmen who demand their rights, but so far as we can learn there are no real workingmen leading the movement, unless the keepers of gin mills and lager beer saloons, like "citizen" Justice Schwab, of police court notoriety, may be called workingmen. Socialism is nothing new in this country, but judging from its aims and results, the type we are now called upon to deal with is radically different from that which we have long had in full development. For many years communistic societies have flourished in the United States, the most prominent of which are the Shakers, the Oneida Community and the Economites, of west Pennsylvania. The members of each of these societies own considerable property in common, but, unlike the plan of the new communists, they have acquired it by industry and thrift, and have never looked to the government for aid to compel the possessors of wealth to part with a portion of it for their benefit. The communism that is now striving to incite a reign of terror, is not an element of home growth, but has been transplanted from abroad. It is an offshoot from the communism of France that rioted in blood and plunder for a brief period in Paris, in 1870, from the Nihilism of Russia, so lately threatening the safety of that government, and from the socialism of Germany, that, a short time since, came near causing the Emperor's death. Judging from their results, we can much better get along with the domestic article than with the foreign. The new communists parade with arms, and threaten to bring on a revolution if their demands are not complied with. They hold public meetings, and make speeches to convert others to their schemes of aggression. The old established communists are opposed to force of arms and never start public agitations to gain legislation for their benefit. They urge no one to follow their system of life. The former declare for free rum and lager; the latter have fundamental rules which exclude all intoxicating drinks. The former by the very existence of their organizations menace all peaceful government; the latter are included among the most orderly and law abiding citizens of our country. The former acknowledge principles subversive to every established religion; the latter are organized into societies based upon forms of religion peculiar to themselves. In short, the former strive to pull down, while the latter labor to build up. The ideas and practices of the settled American socialists, do not agree with those universally accepted by the great body of our intelligent citizens, but they do not conflict with the general welfare, and form no disturbing element in our free republic. The new communists, or rather freebooters, should be taught a few wholesome lessons in the strength and stability of peaceful institutions.

Location of Manufactories.

In looking over the manufacturing industries of the United States, many curious things might be observed in the grouping of industries. There are towns that have peculiar facilities for producing certain fabrications, as for instance, Pittsburgh is by Nature provided with coal and ores within easy reach for the production of iron and steel. Syracuse with Saline springs for the production of salt, and Haverstraw, N. Y., with suitable clay for the manufacture of red brick; but what special adaptation Troy originally possessed for the manufacture of shirts, collars and cuffs, or Worcester for the manufacture of machinery, we have been unable to discover. Certain it is those cities have bscome famous each for the special productions herein cited, and according to present indications they are likely to maintain their advanced positions. Way up in the north of Massachusetts, is the quiet village of Gardner, which ranks as the greatest place for chair making in America, though there are a hundred other towns where both lumber and transportation could be procuerd as well. Waterbury, Conn., is ahead of any other town in the world in the quantity of brass and copper annually rolled out into sheets, though the metals to feed her hungry furnaces must be obtained many hundred miles away. If Miss Flora McFlimsy could trace the elegant French silk of her new dress back to the loom upon which it was woven, she would often have to follow it no further than Paterson, N. J., "the Lyons of America," where more silk is produced than in all the rest of our country, and of as good a texture as any imported. It is sold at the factory for a domestic article, but the enterprising shopkeeper knows full well that Miss Flora would turn up her delicate little nose at the suggestion of robing her graceful form in anything but a foreign fabric, and the goods pass over the counter at a high price as having come from the other side of the Atlantic. Gloversville, N. Y., enjoys the distinction of making gloves and mittens for a large part of this great nation. Although far from being a large town it contains dozens of factories regularly engaged in preparing clothing for the hands. Turning to carpets we find that the most part of them made in this country come from a single ward of the great manufacturing city of Philadelphia. The competition of English carpets in our markets has passed by long ago. The paper-making business is centered in Holyoke, Mass., and Westfield is the crack place for whips. Taunton, Mass., surpasses all other towns in the production of tacks, and Attleboro in cheap jewelry. Lynn is a city of boot and shoe makers, and in aggregate production is only exceeded by Philadelphia. The old Bay State has more leading towns for special manufactures than any other in

the Union. Danbury, Conn., next to being the headquarters of "the Danbury *News* Man," is noted for making more hats than any other American town; and somewhere in the broad meadows of the Connecticut Valley is the little village of Easthampton, whose praises are rung in every clime as the greatest bell making place on this side of the ocean. Meriden, Conn., stands first and foremost in the manufacture of silver-plated ware, while New Britain bears the palm for turning out builders' hardware. It was Seth Boyden, of Newark, N. J., that discovered the process of making enameled leather, and in that city its manufacture is carried on to the greatest extent. Trenton comes to the front as the chief crockery making city, while Pittsburg, not content with being the Iron City, makes, by far, the most glass. Wheeling, West Va., stands first in the production of cut nails. Lowell and Fall River strive with each other for the mastery in producing the greatest amount of cotton goods, while Albany and Troy contend with each other for the supremacy in the manufacture of stoves. But why do manufacturing establishments of the same kind congregate in one place where no special advantage exist for carrying on that particular kind of business?

The success of one pioneer induces others to follow him not only in imitating the industry, but in pitching upon a location.

Again, skilled workmen are easily to obtain near other factories of the same kind, and this may outweigh the disadvantages of close competition. The fact most strongly apparent in the rise and progress of our various manufactures is that enterprise, energy and tact are more essential to success than the natural advantages of a location.

Mechanical Knowledge.

Some knowledge of mechanics is not only desirable but necessary for men in almost every business pursuit. In general business the want of it is scarcely ever felt until some particular occasion requires its application. The rapidly growing use of machinery to accomplish many classes of work, heretofore done by hand, renders the possession of correct and reliable mechanical information more and more valuable to the followers of every industry. The time is drawing near when a special acquaintance with machinery will not be regarded as belonging entirely to a purely technical education, but will be deemed indispensable to all engaged in active vocations. The importance of obtaining the basis of this knowledge before the busy time of life is apparent to every thinking man. Facilities usually afforded youth to acquire any practical mechanical knowledge are so meagre and defective that public interest ought to be awakened on the subject, in order that improved systems may be adopted. At this season the high schools, academies and colleges are sending out their annual crop of graduates armed with diplomas, certifying to their mastery of the various branches of a liberal education. Except in a few schools established to teach the mechanic arts, scarcely any of our higher institutions of learning give any valuable instruction in mechanics. Students are drilled in the details of Cæsar's wonderful engineering operations in Gaul, while works of the present time are neglected as hardly worthy of notice. They are stuffed with Greek and Latin roots, and taught to believe that familiarity with them constitutes the basis and superstructure of a polite, liberal and much-to-be-desired education. Even the most popular text books are from ten to twenty years behind the age. The type of steam engine taught students in our leading institutions of learning is one that has gone out of use many years ago. So with turbine water wheels, and almost the whole class of machinery dwelt upon in the text-books, is it any wonder that graduates have little or no knowledge of modern machines? There is need of a wholesome reformation in the kind of instruction afforded youth in our educational institutions, and it can be secured only by a popular agitation of the matter.

Incrustation in Boilers.

FRANKFORT-ON-THE-MAIN,
GERMANY, May 25, 1878.

Editors Am. Mach.:

You brought out some remarks in the last number of your valuable paper on the means to prevent incrustation in boilers, and different materials were recommended to be put into the water. Allow us to remark, that all methods by which anti-incrust matters are acting in the boilers themselves are not to be recommended. All engineers agree that the water must be cleaned before feeding the boiler. The methods now most used, and the best hitherto used, were therefore based on that principle: lime, soda, and chloride of barium were used, and some add filters; but all these systems are costly, and, if not carefully watched, dangerous, any excess of lime or soda, or of chloride in presence of magnesia causing the boilers to be corroded.

The matters indicated in the said No. have all been tried, and none has proved to be of value. Bark, saw-dust, potatoes, wood-shavings, and similar things are acting mechanically. Fat, oil and tar are sometimes good against incrust, but destroy the boiler-plates. Zinc makes sometimes the sides free from scale, but deposits enormous incrust on the bottom.

The system of Haen (soda and lime, for water containing sulphate of lime, chloride of barium) is that most used in this country, but it requires a good control and is not very cheap.

The best, simplest and cheapest method is now that patented recently in the United States, clearing the water by means of Magnesium. This matter, never used for such purpose, is extremely fit to precipitate lime and clean the water in a very short time. This invention is in operation in Europe since a year and a-half, and proves very well. Nothing is wanted but a tank in which a steam pipe is conducted to heat the water to 40–60° c, and to stir the cleaning matter up. In a quarter of an hour the water is clear. The compound must, of course, be another; for gypseous water and for common water; but introducing hot air from the fire-box sulphate of lime is decomposed by the same matter as carbonate of lime. This method, according to a statistic of 275 boilers, for which the feeding waters have been examined, costs but 2–2½ c. for the majority of the waters, and 3–4 c. for 90 of the others.

Very truly Yours,

WIRTH & Co.

Rules.

(For a copy of the subjoined rules we are indebted to M. Diamond & Co., Hartford, Conn., who are sole agents for the United States and Canada, for Jones, Meyer & Colver's Steel Works, Sheffield, Eng.)

TO ASCERTAIN THE WEIGHT OF SQUARE, ROUND, OR FLAT CAST STEEL, BY MEASUREMENT.

Square Cast Steel, one foot in length.

When the dimensions are given in fourths of an inch, square the number of fourths in the size given, and divide the product by - - - - - - - - - 4.5

If given in eighths,	the divisor is	18.
" " sixteenths,	" "	72.
" " thirty-seconds,	"	288.
" " sixty-fourths,	"	1152.

Round Cast Steel, one foot in length.

When the dimensions are given in fourths of an inch, square the number of fourths in the diameter, and divide the product by - - - - - - - - - 6.

If given in eighths, -	the divisor is	24.
" " sixteenths,	" "	96.
" " thirty-seconds,	"	384.
" " sixty-fourths,	"	1536.

Flat Cast Steel, one foot in length.

When the dimensions are given in fourths of an inch, multiply the width by the thickness in fourths, and divide the product by - - - - - - 4.5

If given in eights, -	the divisor is	18.
" " sixteenths,	" "	72.
" " thirty-seconds,	"	288.
" " sixty-fourths,	"	1152.

Business Specials.

Thirty cents a line for each insertion under this head.

The Pratt & Whitney Co., of Hartford, Conn., make a specialty of Cutters for the teeth of gear wheels, that are shaped entirely by machinery and will make interchangeable all gears that are cut with cutters of the same pitch.

H. Prentiss & Company, 14 Dey St., New York, manufacture Taps and Dies of any pitch or thread, also Spiral Fluted Reamers.

For Drop Forgings of all kinds address The Billings & Spencer Co., Hartford, Conn.

Porous Vitrified Emery Wheels, Rubstones and Sharpeners, are manufactured by the Vitrified Wheel and Emery Co., Westfield, Mass.

Iron and Steel Wire of every description, manufactured by The Worcester Wire Co., Worcester, Mass.

Machinery Depot—New, and second hand Iron, and Wood working Machinery and Steam Engines,—E. P. Bullard, 14 Dey St., New York.

Wrenches.—The Lipsey "Reliable" is strongest and best. Six inch sample by mail 60 cents. Roper Caloric Engine Manufacturing Co., 91 Washington St., N. Y.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

The George Place Machinery Agency, 121 Chambers and 103 Reade St., New York. Iron Machinery of every description. Patent Cold Rolled Shafting, Pulleys, &c.

The Norcross Steam Damper Regulator, the only reliable pressure Govenor in the world, manufactured by The Laflin manufacturing Co., Westfield, Mass.

Questions and Answers.

Under this head we propose to answer questions sent us pertaining to our specialty correctly and according to common sense methods.

(1.) T. H. asked in our December issue: How are twist drills tempered so as to give them their bright clear appearance? Are they previously cleaned, or do they come from the tempering solution in their bright state? A. In hardening twist drills, they are first dipped into common soft soap, then heated in a charcoal fire, having an arrangement so only the blaze or flame comes in contact with the drill. When the proper heat is obtained, (in which great pains should be taken, as much depends upon getting just the proper heat. If not just right, the work will come out black and has to be scoured off with sand and water,) they are plunged into a bath of salt and water and drawn to temper afterwards. Another method is to heat the drills in a muffle or closed furnace until they are cherry-red. Then plunge into a bath of cyanide of potassium and water. No drawing of the temper is required if the proper heat is obtained.

(2.) R. M., Fort Edward, N.Y., asks: What is the most reliable and convenient way to braze a band saw? A. File each end of the saw tapering thin, (one-half to three-fourths of an inch) enough to make a lap the exact thickness of the saw blade. Insert a thin piece of silver (about a quarter thickness of a three-cent piece) between the two tapering pieces. Sprinkle the joints with pulverized borax. Heat a pair of blacksmith's tongs (about an inch and a half wide across the face) to a white heat. Catch both ends of the saw in a vise, allowing the lap to project sufficiently for the tongs to clamp it. Seize the joint with the tongs and hold it till it cools. The silver will be melted and the joint fully brazed. Care should be taken that the lap is made long enough for the teeth to match, also that the back is kept straight.

(3.) W. H. S., Worcester, Mass., writes: How can I thoroughly case-harden iron so a file will scarcely scratch it? A. Heat the iron to a cherry red and sprinkle it with prussiate of potash or cyanite of potassium, then put the article back into the fire and leave it until it has a good red heat. Then plunge it into cold water, holding it perpendicular, and do not move it sideways or it may spring. This process will often be found useful to harden steel tools when it is desired to make them very hard.

(4.) A. F. C., Albany, N. Y., says: What is spelter solder? A. It is composed of equal parts of copper and spelter. It is sometimes called broom solder.

(5.) W. L. W., St. John, N. B., writes: I would like to ask you in reference to the outside pipe condenser used on some of the steamers in the harbors of New York and Boston. Give size of boat, size of engine, pressure of steam, revolutions per minute, size of screw, pitch of screw, size of copper pipes, length of copper pipes on the outside of boat and size of air pump; also where they are manufactured, as I would like to correspond with them. A. These condensers are made by the Delamater Iron Works of this city. One of the largest sizes constructed was for a tow-boat, 90 feet long, 20 feet beam. It had a 22x24 inch tow-boat engine, making 95 revolutions per minute, with 70 lbs. of steam. It had a 7 foot 3 inch propeller, 10½ foot pitch. The air pump was 10½ inches diameter, with 9 inches stroke, double acting. It produced 25 to 26 inches vacuum, running light (about ten miles an hour). It had 6 inch copper pipes (same size as exhaust pipe). The air pump should always be about one-sixteenth the working capacity of the engine. For an ordinary fast-running steam propeller, the length of pipe should be from engine, back around the stern and return to engine.

(6.) J. D., Zanesville, O., says: 1. Give us cause for boiler explosions. Some mechanics claim they will blow up full of water. A. The principal reasons for boiler explosions are using poor and weak material, faulty construction, over-pressure of Steam, low water, burned, corroded, or otherwise damaged plates, inefficient safety valves and careless management. Some of these are immediate causes and others primary. We have heard of instances of boilers blowing up full of water. (See Stephen Roper on boiler explosions in our April issue.) If you want particular information, read the annual reports of the Hartford Boiler Insurance Co. 2. Is there more danger with new boilers or old boilers? A. Generally with old boilers, though, of course, it depends on circumstances. If a new boiler is not strong and well made there is a danger not belonging to one safely used for some length of time. When a new boiler explodes it is likely to do more damage than an old one. A careful and efficient inspection by an expert will detect danger, if there is any, and ninety-nine boiler explosions out of every hundred might be prevented if this precaution were always adopted, and the defects thereby discovered promptly attended to. 3. What will make the best metal for safety plugs to melt out when water gets low? A. This depends upon circumstances; Rose's fusible alloy is composed of lead, one part, tin, one part, and bismuth, two parts. It melts at 200 deg. Fah't. If a metal is required to melt at a higher temperature decrease the proportion of bismuth. 4. Will safety plugs in fire box save boilers from blowing up? A. No; they are not to be relied upon for the purpose.

(7.) G. W. F., St. Louis, Mo., writes in reference to a method for balancing pulleys. In our April issue we gave a way to do it by filing off from the heaviest part until the pulley will rest upon two straight level edges in any position. This, although a correct way, is slow and therefore expensive, especially on large pulleys. Turning up on the inside will, in many cases, balance a pulley perfectly, leaving an equal distribution of metal upon all points of the rim. The method employed by the Putnam Machine Co., William Sellers & Co., and many other large machine works, is to first ascertain just where the heavy part is, by placing the pulley on straight level edges and then bolting to the opposite side, inside the rim, a cast-iron lug of sufficient weight to balance the heavy side. These lugs are kept on hand for the purpose of different weights and bored with a sing e hole for the bolt. If not of exact weight required, a part is chipped off. For pulleys from 24 to 36 inches diameter they weigh from 4 ounces to a pound. The head of the bolt is, of course, countersunk in the rim of the pulley, so as to leave it smooth. If a pulley is cast true it requires but little turning or balancing. The whole loss of weight in turning and boring the pulleys made by Wm. Sellers & Co. last year amounted to only 4 per cent.

(8.) W. S. H., Croton Falls, N. Y., writes: Will you be kind enough to give me some few practical hints on the manufacture of brass tubing; how the brass is formed up for small tube and how it is drawn so smooth and true? A. The sheet brass is first passed through a machine that slits it into strips of proper width for the size of tube required. Each strip is then curved with a mallet at the end in the form of a trough and pounded to a taper small enough to enter the die. It is then oiled and drawn through four steel dies of different sizes at one operation, over a steel taper, plug or mandril. This forms it up in tube shape. The smallest die is one-sixteenth of an inch larger than the tube is to be when finished. The seam is then closed and solder distributed by hand along its whole length by means of an angular-shaped strip of German silver. Next it is passed through a furnace constructed for the purpose which melts the solder and cements the seam. The tube is then pickled in a bath of diluted sulphuric acid until the discolor and grease are removed, then washed in clear water and dried. The next operation is to file off the rough solder along the seam after which it is again drawn through a steel die and from this it comes bright, smooth and of the exact size required.

(9.) M. B., Chicago, says: What substance can I use that will stick pieces of metal, such as pattern letters, to a wood pattern so as not to be easily brushed off? A. Shellac, mixed with a little lampblack, will do it.

(10.) M. M., Worcester, Mass., writes: Is there any cheap and convenient way for making patterns for casting figured iron and metal work? A. Yes; go to a book-binder's and get some of the embossed cloth used to cover books. You can select from dozens of beautifully figured designs what you most fancy. Lay this on the pattern with shellac, and from it make your mold for casting. Simple as the process is it has been held as a valuable secret, and this we believe to be the first publication of it.

(11.) J. J. G., Hartford, writes: Can you give me the proper way to lay out the finger board of a guitar or banjo for fretting, so as to get perfect tones. There is a way to do it, I believe, by figures, and get it mechanically as well as musically correct. A. There is no rule to lay out the finger board for fretting. The method adopted by manufacturers is to measure the finger board and position of frets by another as a pattern. The least variation of the frets would change the tone.

MANUFACTURES.

NEW YORK.

A scissors manufactory is to be started in Ilion, N. Y.

The Delamater Iron Works, foot of West 13th St., are very full of work.

T. R. Almond, 84 Pearl Street, Brooklyn is making a new style of small drill chuck.

Wilson & Roake, Water & Dover streets, are pushed with orders for their new small power engine.

Townsend & Preston, 180 Centre Street, have a shop full of work, with orders enough to keep busy till fall.

O'Neil & Co., 178 Centre Street, have some late improvements in their metal shearing and punching machines.

The Bullard Machine Co., 14 Dey Street, has been dissolved and superseded by Mr. E. P. Bullard, who carries on the business as before.

The National Antoxide Co., 87 Liberty Street, are making a very useful liquid preparation to prevent machinery from rusting without injuring the metal. It is not difficult to remove and does not spoil the appearance of any article it is applied to.

Fletcher, Harrison & Co., 265 West St., employ at present 182 men at their machine shop. They are building an engine 46-inch cylinder, 8 foot stroke, for a steamboat on the Boston & Hingham route; also an incline engine 16 inch cylinder 4 foot stroke for a new ferry boat at Coxsackie. They are making a pair of boilers for the steamer Magenta, and one of steel, 6 feet diameter, 17 feet long for a steamboat in Florida.

MASSACHUSETTS.

A. F. Prentice & Co., Worcester, are manufacturing a new lever drill.

A. F. Henshaw, Worcester, is about to bring out some improved styles of foot lathes.

The Norcross Steam Damper Regulator, manufactured by the Laflin manufacturing Co., Westfield, is fast growing in favor.

The Lathe & Morse Tool Co., Worcester, propose to bring out a new style of upright drill.

The Worcester Wire Company have a steady and increasing demand for their production of iron and steel wire.

The Victor Feed Water Heater and Purifier, made by Wm. Allen & Sons, Worcester, is a success, and is gaining in popularity.

David W. Pond, Worcester, is employing 90 men, and has a fair demand for late improved machine tools.

The Crompton Loom Works, Worcester, are pushed to their fullest capacity to supply orders.

The Holyoke Machine Company are supplying two 54-inch turbine water wheels for the water works at Lewiston, Me.

Both the Screw Wrench factories at Worcester, L. Coes & Co., and A. G. Coes & Co., are running full time with a good force of workmen.

The Washburn & Maen Manufacturing Company, Worcester, are running night and day, and can scarcely keep up to the demand for iron and steel wire.

E. N. Boynton, Worcester, keeps his shop very busy in making hand and power drills, and bolt cutters, both for home, and foreign trade.

The Union Water Meter Co., Worcester, have had no experience in dull trade, but keep their shop always full of work to supply orders.

Jerome Wheelock's engine shop, in Worcester, is fairly busy on orders. Mr. Wheelock is at the Paris Exposition, where one of his engines is running and attracting considerable attention.

The Gilbert & Barker Manufacturing Company, Springfield, are now making fully one-third more of their gas machines than in any previous year, and have now about 1700 in use.

P. Blaisdell & Co., Worcester, are kept busy making their improved drill presses with quick-return motion, lathes, and other tools. Their tools are sold at machinery stores in all the large cities.

Wm. H. Eddy, Worcester, has received a large number of inquiries for his twist drill grinding machines from all parts of this country and some from England. The machines he has built that are now in use, give excellent satisfaction.

There are no signs of dullness at the Knowles Pump Works, at Warren.

The Worcester Machine Screw Company are doing a brisk business. Thirty-five men are employed ten hours a day, and an enlargement of the works is contemplated. They have lately brought out some new styles of machine-screws, adapted to steam engines and large pieces of machinery.

Young and Wheeler, Boston, have lately put into their shop three new lathes, and taken on four additional men. They make improved screw, power, and lever presses for which they are supplied with orders for weeks ahead.

The Wason Manufacturing Company are building 20 cars for the New York Elevated Railroad; 17 for the B. F. & C. I., 15 open and 2 closed; 19 cars for the Brooklyn & Rockaway Beach, 15 open and 4 closed; 2 for the Housatonic road and 2 for the Utica and Black River.

F. B. Norton, Worcester, is making a porous emery wheel which is not affected by heat, water, or acids. It does not glaze, nor smell. It is strong enough to stand running at a high speed, but does not require to be speeded as high as some other wheels in order to cut well. These wheels have been on the market but a year, and have acquired a good reputation wherever used.

The Putnam Machine Co., Fitchburg are building a 26 inch cylinder engine for the Government arsenal, at Rock Island, Ill., and have lately sent one 34 inch cylinder engine to Louisville, Ky. They are employing a force of 325 hands, but have capacity for a thousand. This company manufacture a variety of machine tools, and make a good display at their extensive warehouse, 115 Liberty St., New York.

RHODE ISLAND.

The Diamond Emery Wheel & Machine Co., Providence, have just brought out a new style of machine on which to run emery wheels.

Mr. George H. Corliss, Providence, is building an 80 horse-power engine which will be entirely different from any he has heretofore constructed. It will have improvements on the cylinder, valve motion, pillow block, bed, &c., which will be secured by patents. When completed it will be set up and tested in his own works.

CONNECTICUT.

The Billings & Spencer Co , Hartford, are running full time, and have plenty of orders ahead.

A. F. Cushman, Hartford, is doing well with his new style of chucks, for which there is an increasing demand.

OHIO.

The Barney & Smith Manufacturing Co., Dayton, have just added to their blacksmith shop 25 new fires, a 2,000 lbs. steam drop, one 1,000 lbs. and one 350 lbs. steam hammer. They are very busy on orders for cars.

The American Cast Steel Company, Cleveland, are in complete working order, and are making at present fifteen hundreds pounds of crucible steel daily, though their capacity is a ton a day. This is a new industry in Cleveland.

PENNSYLVANIA.

J. Henry Mitchell, 604 Beach Street, Philadelphia, is about to manufacture a new style of hoist for machine shops.

The Baldwin Locomotive Works have just built 6 separate motors for the Broadway Railroad Co., Brooklyn. Two for the Brooklyn City Railroad Co., and 3 for the Bushwick Railroad Co., of the same city. They have also just completed one for a tramway in Milan, Italy, and one for Adelaide, Australia.

DELAWARE.

The Edgemoor Iron Company, Wilmington, are constructing an iron bridge for the Delaware Western Railroad Company, to take the place of a wooden structure at Ashland station.

Exports.

Stone & Hazelton, Boston, have just sold two small lathes to go to Australia.

Gould & Eberhardt, Newark, lately shipped one of their Gear Cutters to Pueblo, South America.

Lathrop & Co., Newark, recently shipped a lot of their Victor Patent Adjustable Pipe Wrenches, to England.

A. F. Prentice & Co., Worcester, lately sold two of their new brass worker lathes to a Chicago house to go to Australia.

A Worcester firm makes band saws by milling out the teeth, which they claim to be superior to teeth clipped out.

Shipments of "North's Universal Lathe Dog" have recently been made from Philadelphia, in response to orders from London, Paris, Hamburg and Australia.

The Farrell Foundry and Machine Company's works at both Waterbury and Ansonia, Conn., are active and full of orders on home and foreign work. They have in hand large orders for sugar mill machinery for Cuba and the Sandwich Islands, requiring their running extra time.

The Chase Manufacfuring Company, New York, have sold their pipe-cutting and threading machine to every civilized country in the world. One of their last shipments was four machines to England, and three to Australia. They are very extensively used throughout this country, being the only machines that do the work with little expenditure of power. It cuts a square chip after the manner of a lathe tool, and leaves no ragged edge inside or out. It is easily adjusted to any sized pipe or round iron.

Machinists' and Engineers' Supplies.

Trade is quiet as it usually is at this season of year, but prices, as a rule, remain steady. The most important change, since our last, is a reduction of 10 to 15 per cent. in the price of twist drills and reamers, by the Morse Twist Drill & Machine Co., who have issued a new general price list of their goods. T. R. Almond, 84 Pearl St., Brooklyn, has brought out a new drill chuck of smaller size and of somewhat different construction from that formerly made by him. He has already received orders for several hundred of them from machinists' supply houses. We will give a full description of it in our next. Machine screws are in first-rate demand throughout the country, which is indicative of activity in some kinds of machinery manufactured. The Victor Pipe Wrench, made by Lathrop & Co., Newark, N. J., is a very popular tool and the demand for it is something unusual for a new article. A new steam trap will shortly be introduced by a party in Philadelphia. The demand for wire is remarkable and the mills are all running briskly. The improvement in railroad business will, it is expected, make a better market for supplies and lead to a better feeling in the trade.

Messrs. A. B. Warner & Son, 28 West street have issued their June schedule of iron and boiler makers supplies in stock. It shows a very extensive assortment.

Iron Review.

PIG IRON.—But little business is being done, and no improvement expected before August. We quote, No. 1, Foundry, $17 to $18; No. 2, $16 to $17, and Gray Forge, $15 to $16. Scotch Pig continues in light demand and prices remain as before. Eglinton, $22.50 to $23. Glengarnock, $23.50 to $24, and Coltness $24.50 to $25.

MANUFACTURED IRON.—The trade continues very quiet at the base price of two cents a pound for good refined bar. Business is reported very dull at the mills and on large orders concessions can be obtained.

STEEL RAILS.—Sales have been recently made, but on private terms. The Erie Company are in the market for 20,000 tons to complete their change of gauge. Prices continue unchanged at $43 to $44.

IRON RAILS.—Very little business is being done, and quotations are $33 to $35.

WROUGHT SCRAP.—Inquiries are limited and prices remain unchanged at $20 to $21, from yard. One lot of 200 tons sold on private terms.

STEEL.—Moderate inquiry, but sales are in small lots only. Prices continue unchanged.

TANK, PLATE AND SHEET IRON—Trade is quiet, and there have been some slight reduction in price. Boiler tubes have been reduced 25 per cent. from their previous selling price. We quote store prices as follows: Tank Iron @ 2¾; C, No. 1, @ 3; Shell @ 3¼; Best Flange @ 4½; Soft Patch @ 6½; Boiler Rivets @ 3¾; Boiler Tubes list price less 40% discount; Sheet Iron @ 10 to 14, 2¾. Mill prices furnished on application.

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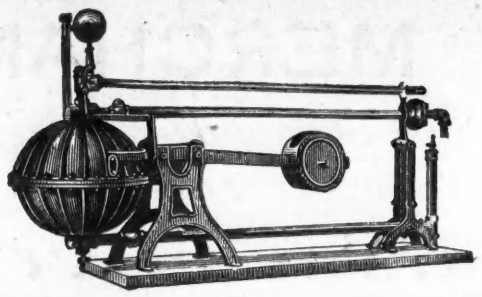

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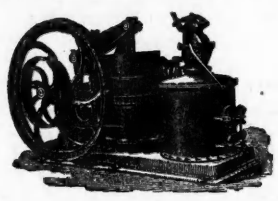

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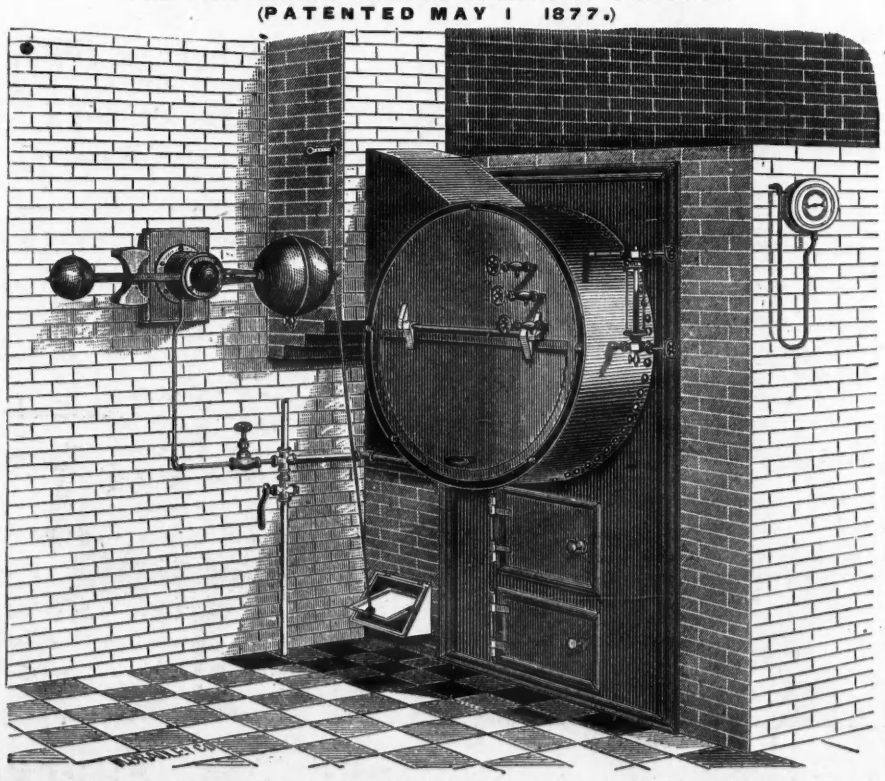

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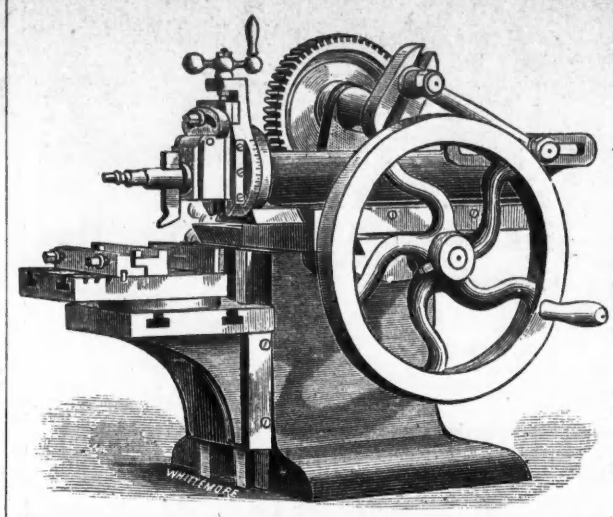

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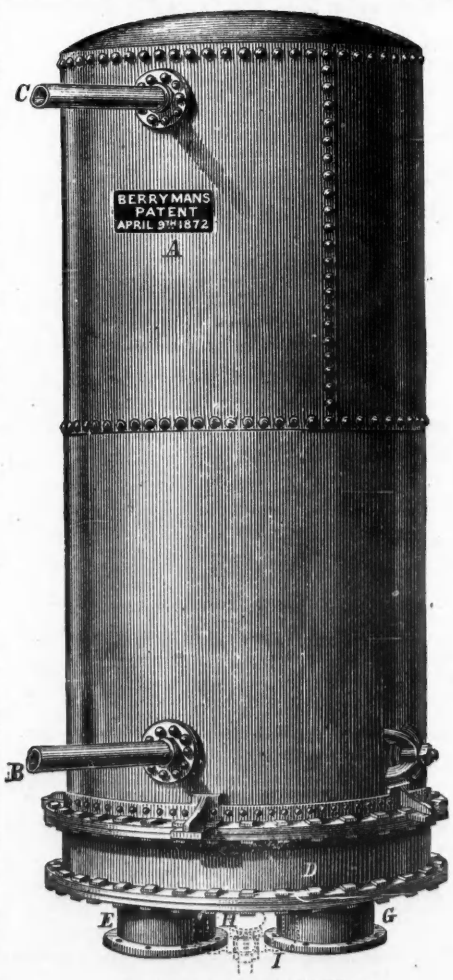

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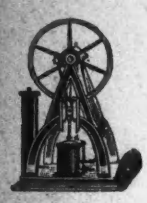

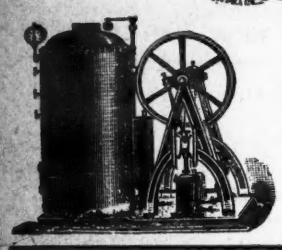

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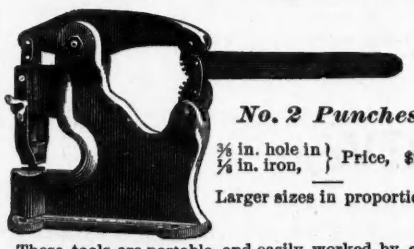

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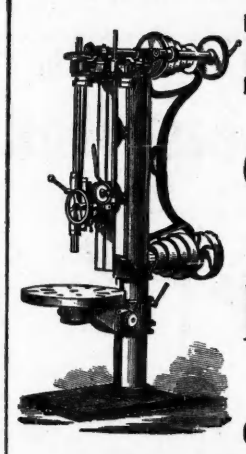

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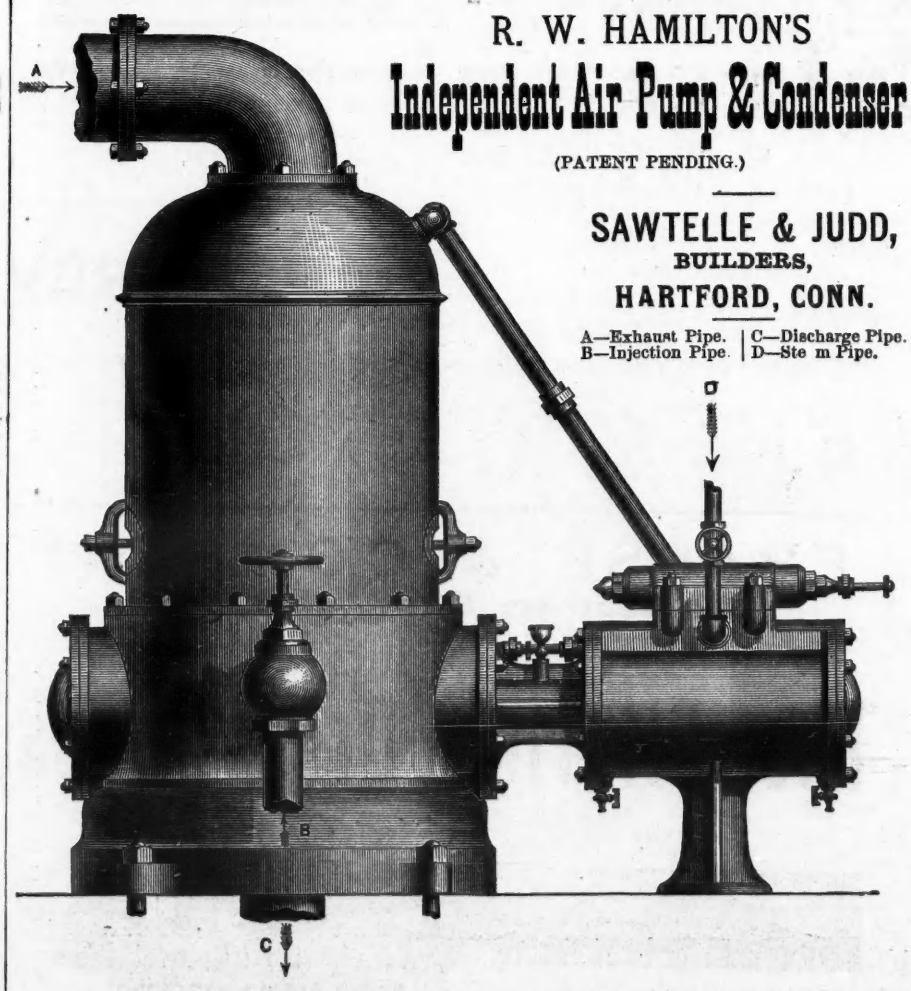

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⅝×16	14	12	10	3/16	¼ & 5/16
$3\frac{4}{10}$	$3\frac{8}{10}$	3	3	$2\frac{8}{10}$	$2\frac{7}{10}$
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$\frac{8}{10}$	$\frac{6}{10}$	$\frac{4}{10}$	$\frac{2}{10}$
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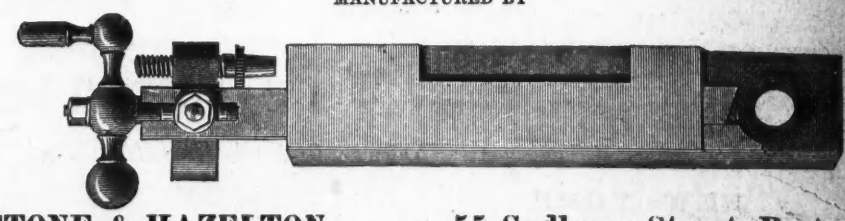

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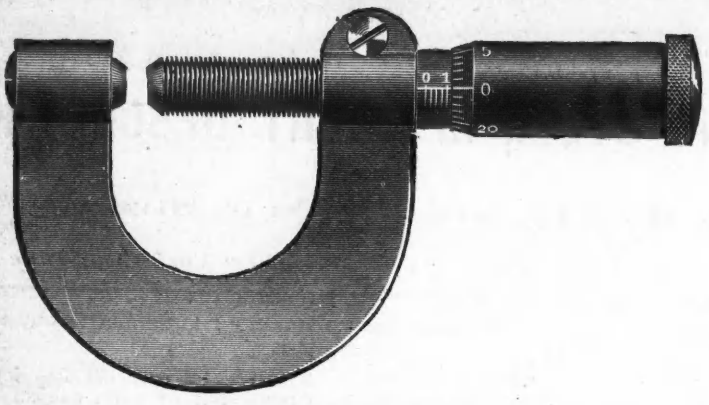

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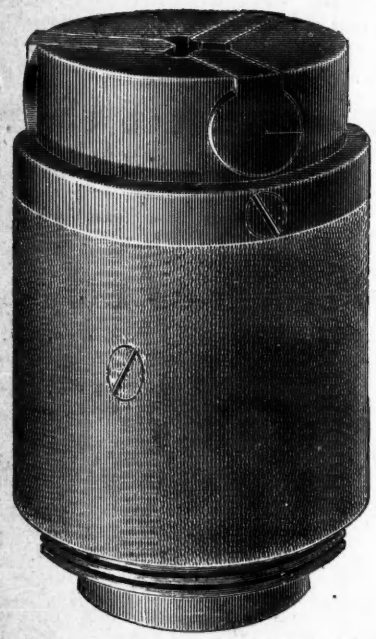

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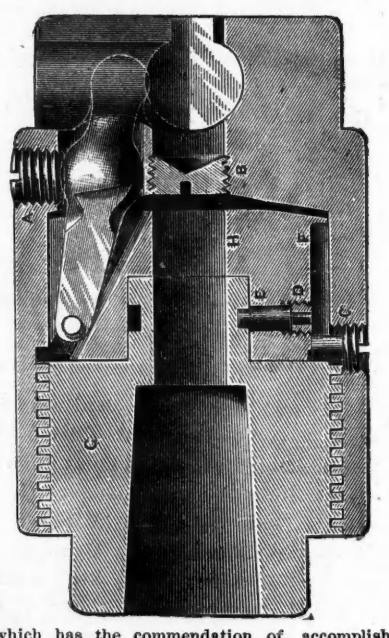

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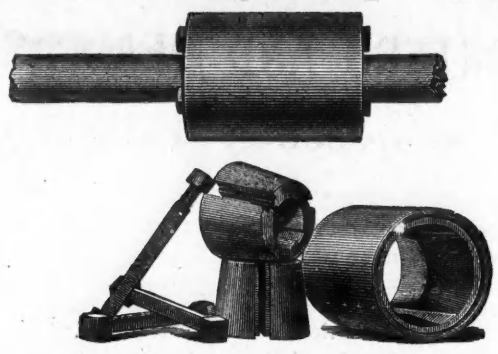

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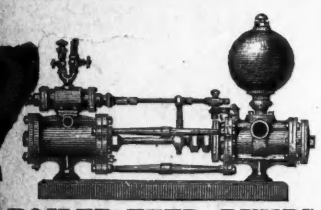

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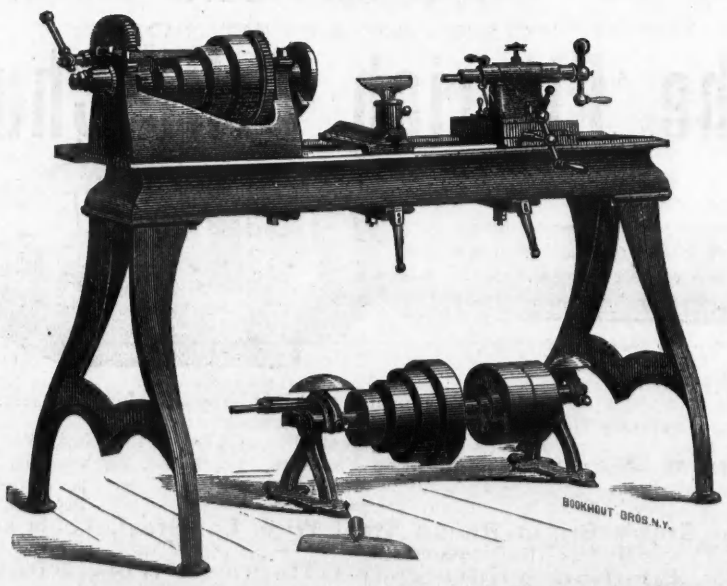

Above cut represents our 14 in. Swing Brass Finisher's Lathe.

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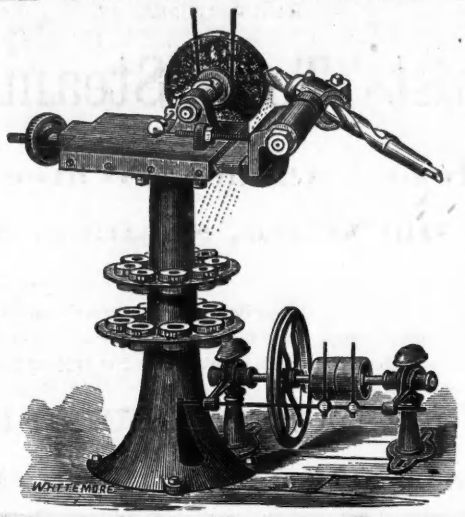
☞ Requires no skilled workman to run this machine. Either Crooked or straight drills ground quickly and accurately.



This Machine grinds drills to the same shape as the best machinists do by hand. It enables the operator to make the cutting edge or lip of the drill thick and strong so it will not crumble away in drilling, also to make the lip true with the twist or outside surface.

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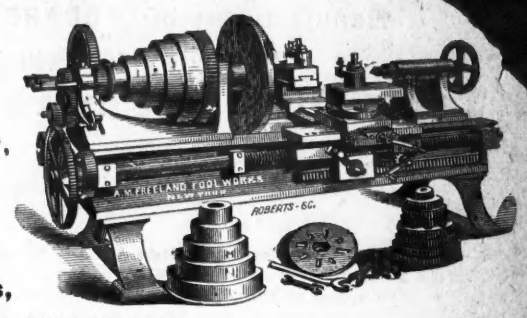

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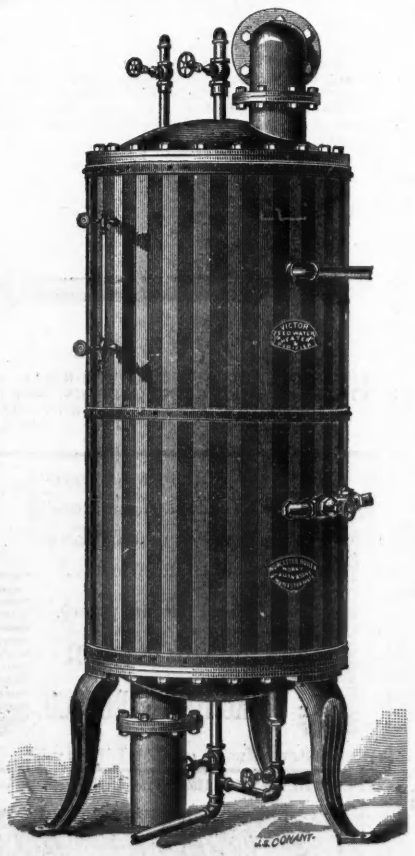

(Jones' Patent, Nov. 6, 1877.)

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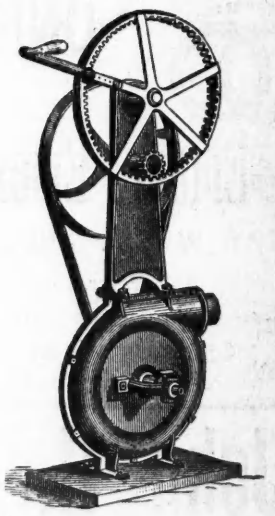

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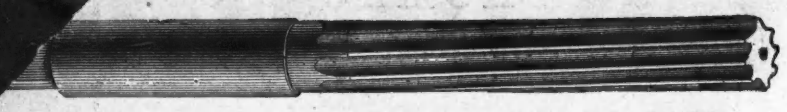

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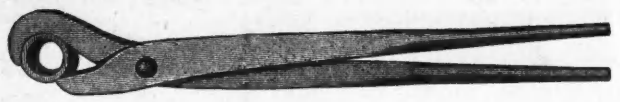

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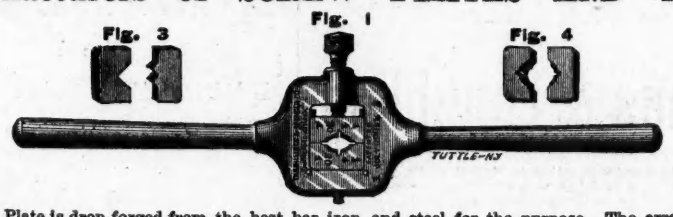
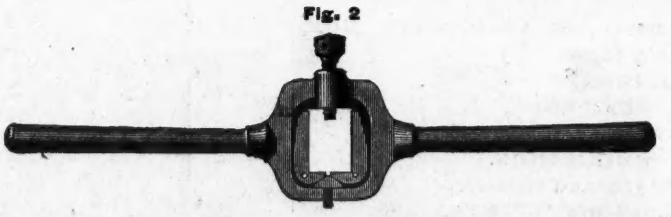


This Screw Plate is drop-forged from the best bar iron and steel for the purpose. The arrangement for holding in the Dies is novel and new. Two feathers hold the Dies in position, as shown in cut Fig. 2, swing in and out. By turning the screw from the top Die, and press on the pin at lower edge of the plate, leave the Dies free to drop out. Fig. 3 represents a pair of Dies for holding Taps used in the plate in place of Thread Dies, making a very convenient Tap Wrench, saving the necessity of an extra wrench as it combines the two.

Fig. 2



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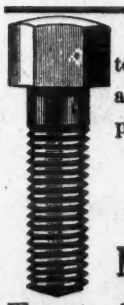

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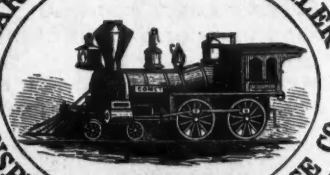

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